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ALIDA, wife of Mr. William McDonald, of Albany, N. Y., died, at her home in that city, on the afternoon of March 11. The funeral services will be held to-day.

[OFFICIAL NOTICE.]

Eighth Annual Meeting, Ohio Gas Light Association.

OFFICE OF SECRETARY, February 12, 1892.

The Eighth Annual Meeting of the Ohio Gas Light Association will be held at Columbus, O., on March 16 and 17, 1892.

The following papers are promised:

1. "A Basis for Equitable Rates to all Consumers," by M. A. Gemuender, Columbus, O.

2. "The Prevention of Errors in Reading Meters," by A. F. Nash, Windsor, Ont.

3. "The Relation of Holder Capacity to Output," by G. N. Clapp, Middletown, O.

4. "How to Put a Small Gas Works on a Paying Basis," by C. H. Marden, Coshocton, O.

5. "The Testing of Ammoniacal Liquor," by George Osius, Detroit, Mich.

6. "Should Gas Companies do all Gas Fitting," by W. H. Anson, Columbus, O.

7. "The Determination and Regulation of the Proper Proportions of Primary and Secondary Air and of Steam in Regenerative Furnaces," by Fred. Bredel, Milwaukee, Wis.

8. "The Relation between Increase of Output and Decrease in Cost of Manufacture and Distribution," by Henry Padan, Portsmouth, O.

9. "Gas Burners, and the Gas Company's Interest in Them," by J. A. Faux, Pittsburgh, Pa.

10. "The Present and Future Coal Tar Market," by C. H. Welch, Athens, O.

The Question-Box will be opened as usual.

The Chittenden Hotel will be our headquarters, where those in attendance at the meeting will be granted a reduction in rates to $3 per day. The sessions will be held in the Gas Company's employees' hall, at the gas works, one square from the hotel.

A model Stroh & Osius concentrator, of a size adapted to a small works, will be exhibited in operation in the scrubber room at the gas works.

There will be the usual public exhibit of gas stoves, etc.

The Association badges will be ready for distribution, to those ordering them, at the meeting. IRVIN BUTTERWORTH, Sec.

OBITUARY—MR. JOHN P. KENNEDY.

A brief mention was made in our last issue of the death of Mr. John P. Kennedy, who succeeded the late Commodore Garrison in the Chairmanship of the Mutual Gas Light Company of this city, and we now place before our readers, in accord with our promise, a condensed account of Mr. Kennedy's connection with the gas industry. At the outset we wish to express our indebtedness to Mr. E. S. T. Kennedy, who was interested with his father in the direction of the Mutual Company, for valuable assistance in compiling the record that we print.

Mr. John P. Kennedy was born in this city, on November 22d, 1820, and through the death of his father (1829), was early brought to face with the necessity of doing for himself, at least in a measure. In those days the public school system of New York was but little like that of its successor of to-day, and what with his struggles to assist a widowed mother (his affection for her was most beautifully illustrated all through his early trials and his subsequent success) and to acquire an education, the youth sowed the seeds of that sturdiness of character which marked his subsequent career. All too soon his schooldays ended, and at the age of 15 we find him in the employ of his uncle, Mr. James Hoy, of Trenton, N. J., where the latter carried on a cotton mill. Here Mr. Kennedy's natural taste for mechanics found good chance for development, and while not at work at the looms he tried his prentice hand on repairing old machinery, following which came many examples of new apparatus devised by him for perfecting the art of spinning. Slow but sure, he eventually succeeded his uncle in the proprietorship of the mill. In 1851 disaster overtook the mill in the shape of a fire that levelled it to the ground, and a total loss was incurred. The margin of profit in that line of industry was not sufficiently tempting to induce him to rebuild; and he associated himself with his cousin, Mr. James Hoy, of the firm of Perdicaris & Hoy, iron founders at Trenton, who were among the first in this country to engage in the manufacture of gas apparatus

and the construction of gas works. Acting in the capacity of Chief Engineer for the firm, he overlooked the erection of gas works at Petersburgh, Lynchburgh, Portsmouth, Alexandria and Charlottesville, Va.; Charleston, S. C.; Columbus and Macon, Ga.; Cumberland, Md.; St. Paul, Minn., and other points. In 1858 the firm became Hoy & Kennedy, in which year they built the Natchez (Miss.) works, and later on the Orange (N. J.) works were constructed. The war of the rebellion caused them to turn their attention to the Eastern gas field, and in 1860–63 the Metropolitan works, this city, were constructed. In 1864 they completed the Citizens works at Newark, N. J. In 1866, when gas works construction received something of a check, the firm turned their attention to other lines of enterprise, and (1866–7) built a steam and horse railroad in Augusta, Ga. In 1868 the firm became interested in the railway supplies business, with headquarters in New York, and about that time they also became the proprietors of the New Castle (Del.) Machine Works. It was at these shops that the apparatus for the New York Oxygen Gas Works was turned out. In 1870 the equipment of the New Castle shops was removed to the Red Hook district, South Brooklyn, N. Y., and the title of the foundry was that of the Atlantic Dock Iron Works. At these shops all the machinery for the following gas plants was turned out: New York Mutual; Metropolitan, Brooklyn, N. Y.; Detroit Mutual; Citizens, Providence, R. I. Besides these undertakings, many separate orders for gas apparatus, such as holders, purifiers, bench castings, etc., from different points in the country, were filled. During his career Mr. Kennedy reconstructed several gas plants, notably those at Jersey City and Hoboken, N. J., and Baton Rouge, La. Mr. Kennedy (1872) was the first to introduce the manufacture of water gas in New York city. The Gale and Rand process was the system adopted, which, after many ups and downs, and after thorough and protracted trial, was discarded as a failure. Other experiments with water, wood and oil gases at the Mutual works finally resulted in the permanent adoption of the Wilkinson process, to which much study was given by deceased. In 1877 Mr. Kennedy retired from the construction business and succeeded the late Commodore Garrison (with whom he had maintained close business relations for many years) as President of the New York Mutual Company, which position he maintained at the time of his decease. Deceased was the founder of the Hazelton Boiler Company, of this city, in which he was associated with his two sons. He was at one time President of the Wheeling & Lake Erie R. R. Co., and of the Howe Sewing Machine Company, and also had many other positions of trust during his long and varied career. He was an enthusiastic yachtsman, and was Vice Commodore of the New York Yacht Club.

Deceased was an inventor of no mean ability and patented many inventions, while several others were never protected by letters. Of his immediate family his widow, two sons and a daughter survive.

Mr. Kennedy was a man of fine presence, and easily found a place for himself in the affections of those in whom he confided, and while it is true that his name is identified with many opposition enterprises even those whom he opposed were never slow in awarding him the credit that one gives to a manly un-ambushed opponent. Interment was made at Woodlawn Cemetry, on the afternoon of March 1st.

We regret to chronicle the death, on March 1st, at his residence, No. 4940 Frankford avenue, Phila., Pa., of Mr. Thomas Wilbraham, senior member of the firm of Wilbraham Brothers. Deceased was in his 65th year.

The Ohio meeting promises to be a complete success, and President Wilkiemeyer we imagine will have some pronounced views in his annual message. What with the address, the paper list, the concentrator exhibit and the display of gas appliances, the time set for the sessions will be fully taken up.

The Market for Gas Securities.

The city gas share market was dull and strong during the week, Consolidated to-day (Friday) opening at 112¼ to 113. Equitable is very strong at 142 bid, and Mutual is also in demand at 128. The annual meeting of the Standard Company, which is set for May 11th, promises to be a lively one, and some o'er true tales may be told. In the meantime we presume the Company is on the lookout for another "General Manager." The Brooklyn consolidation is not beyond the appraisal stage, the valuers being busily engaged; but some of the appendages of the Rockefeller-Rogers coterie are making slates for the future management. In the meantime Nassau stock has climbed to 143. Laclede is dull, while Baltimore Consolidated is at 50½. Chicago gas shows no change of moment.

[Official Report—Revised by the Secretary—Continued from Page 334.]

TWENTY-SECOND ANNUAL MEETING OF THE NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

Held at Young's Hotel, Boston, Mass., Feb. 17 and 18, 1892.

Second Day—Morning Session.

The President then introduced Mr. William E. McKay, of Boston, Mass., who read his paper, entitled

A GAS WORKS AS A HEAT ENGINE.

"Heat and light are modes of motion, and are mutually convertible." The primary purpose of carbureted gas is illumination, and the light is obtained through the initial agency of heat. In a gas works, the coal and the oil are not of service until they have been heated, and the gas cannot be conveniently handled until it has been cooled; the gas superintendent's energies are directed, first, to getting heat, and then to getting rid of it.

The study of this division of gas manufacture is a study of figures, schedules, formulae and computations, dry in themselves, dusty in their accumulation, and frequently fallacious in their deductions. In the following paper, the observations recorded have been taken at the Calf Pasture station of the Bay State Gas Company, where the apparatus in use for the manufacture of carbureted water gas is the Flannery process.

In the operation of a boiler, a steam engine and a condenser, coal is put under a boiler, and water is put into a boiler, and work is performed by the driving pulley of the engine, whilst the exhaust steam is carried to the condenser. The conditions of the operation are made known to the steam engineer by the aid of measures of weight, volume, temperature and pressure, and by the indicator card. In a gas machine as a heat engine, the boiler and steam engine are replaced by one piece of apparatus—the generator—which, when on blast, stores the heat afterward utilized in making gas. The products of the make are then carried to the condensers. The circumstances of the operation of the apparatus and the conditions of its contents are made known to the gas engineer by the aid of measures of weight, volume, temperature, and pressure, and by the gas analyses.

In the practical operation of a gas works, it is evident that variations of temperature have a far greater effect upon the volume and condition of the gas than variations of pressure. When it is considered that nearly 14 inches of water pressure are balanced by one inch of mercury, or barometric pressure, changes in volume due to changes of pressure at different points in the apparatus may be disregarded. It is otherwise with changes of temperature. The co-efficient of expansion of air and permanent gases is .002,037 for one degree F. In accordance with this co-efficient, Table 1, Note A, has been prepared, showing the large increase in volume of a large bulk of holder gas, for a moderate rise in temperature. Thus it becomes necessary to select a reference point to which to reduce volumes for comparison, and the temperature of 60° F. has been used.

The average outside temperature, for 1891, was 50.7° F., and, from Table 2, Note B, it appears that for the months of September and October the average temperature was 59°, therefore, the manufacturing records for these two months have been used to furnish the following data:

Gas made	175,174,000 cu. ft.
Carbon consumed in generator per 1,000 cu. ft. gas (coal used, less ashes withdrawn)	23.89 lbs.
Naphtha per 1,000 cu. ft. gas	4.80 gallons.
Note C	28.00 lbs.
Candle power	26.75

(Specific gravity, 70° B.)

In December, 1891, and January, 1892, we had in service an efficient apparatus for settling, separating, storing and measuring the tar and drip refuse from the gas made. This period furnishes the following data:

Gas made	189,253,000 cu. ft.
Tar "	138, 711.15 lbs
Tar per 1,000 cu. ft. gas (Note D)	.722 lbs.

The average analysis of the final or holder gas is shown in Table 3, Note E, and the weights of the elemental parts, per 1,000 cubic feet of dry gas, are given in Table 4, Note F. It will be noticed that sulphur compounds have been disregarded; several tests made in August, showed that in the unpurified gas there was present not more than 10 grains of sulphur.

From Table 4, the total oxygen per 1,000 cubic feet gas is 13.65 lbs. From this can be directly deduced the amount of steam dissociated in making gas; and we find the steam to be 15.36 lbs., Note G. It is evident, then, that the weight of the hydrogen contributed to the gas by the dissociated steam is 1.71 lbs.

Summing up these averages, (Note H.) we find that for every 1,000 cubic feet gas made there are used in the generator, from the coal, the oil, and the steam, 47.41 lbs. carbon, and 6.19 lbs. hydrogen, and there is recovered in the final gas, and in the tar, 30.579 lbs. carbon, and 5.78 lbs. hydrogen; and, therefore, the difference, or 16.831 lbs. carbon, and .409 lbs. hydrogen, must be burned from the set when on blast.

From the CO and the CO_2 in the final gas, it appears that 9.216 lbs. of the carbon in the final gas is from the coal. Hence, 14.674 lbs. carbon burned while on blast are from the coal. There remain 2.157 lbs. carbon and .409 lbs. hydrogen burned from the set whilst on blast. These must be furnished by the oil, Note I. This is 9.16 per cent. of all the oil used per 1,000 cubic feet gas made.

The average composition of air is given in Table 5, Note J. The total air necessary for the combustion of 16.831 lbs. carbon and .409 lbs. hydrogen is thus found to be 2,734 cubic feet.

The average analysis of the waste blast gases, at the time, is given in Table 6, Note K. From this, it appears, that the combustion is not quite perfect; that is, not quite enough air was supplied to insure complete combustion. It also appears that the nitrogen unaccounted for by the oxygen present in the analysis, is 5.12 parts, by weight, of all the blast gases; this corresponds with .21,065 parts, by weight, of hydrogen, which has combined with oxygen and fallen to water; this is nearly equal to .4,437 lbs. hydrogen per 1,000 cu. ft. gas made. (Note L.)

If the oil deposits were completely burned from the machine, while the blast was on, the operation of gas making would not require interruption to allow repairs to be made to the superheating chamber. The coal supply being renewed every few hours, there would be no diminution in the efficiency of the operation of the engine. But these conditions do not obtain.

As the superheater is the storehouse for the heat developed by the combustion of the gases from the generator, the arrangement of the bricks to insure the absorption and retention of this heat is of prime importance. The side walls of the superheater chamber are efficient for the retention of the heat within the chamber, but the work of taking up heat from blast gases, and giving out heat to the oil gases is ultimately thrown nearly entirely upon the small loose bricks called fixing bricks. If these are laid in straight tiers, without crossing, the blast gases pass into the air too freely, and do not part with as much of the heat as should be the case. If, on the other hand, the bricks are crossed in tiers, the flame impinges upon a fresh surface, every few inches in height, and is deflected at right angles twice before it is again ascending when the process of deflection is repeated in this way, the surface of impact is much increased (Note M.)

These bricks are used under the following conditions. Raised, during blast, to a high heat, when the machine goes on to make gas, the pores of the brick are filled with the vapors of the oil, the blast being turned on again, these vapors and carbon deposits are burned from the pores of the brick, working from the surface inwards, before the brick has been entirely cleaned, the machine goes on to make gas again, the result being that there is left in the brick a small permanent deposit, at the very core, or heart; this closing of the pores, and coating of the surface of the pores, continues, and the brick is finally said to be used up, worn out, or "carbonized." It is evident that when first placed in service, no excess of air is required to insure efficiency in the service performed by the bricks. Afterwards it becomes necessary to increase the supply of secondary air, for the purpose of clearing the surfaces of the bricks, thus to assist them in the work of gas making; this assistance is at the expense of increased fuel. In increasing the supply of air to the gas machine, it is to be noted that the area of opening, in a gate valve, is not directly proportional to the linear opening, measured along the line of the valve stem. Table 7 (Note N.) shows the variation of the area of opening.

Under unvarying conditions of service, the size of the section of the superheater bricks rendered useless by the carbon deposits is a function of the time of service. The practical question of frequency of renewals depends upon the cost of renewal compared with the economy effected by the use of new bricks. At the Calf Pasture Works, 2,600 bricks, weighing 7 lbs. each, have been advantageously used to make more than 150,000,000 cubic feet of gas.

The volumetric heating capacity of the fixing bricks being reduced by the formation of the dense core already described, this formation proceeds nearly proportionally in the direction of the 3 axes of dimension, if the brick be considered to be held in position without support by contact. Table 8 (Note O.) gives the relation between the volumes of the impaired and unimpaired portions of the bricks, for different fractions of the linear dimensions.

Having examined the conditions under which the waste gases leave the gas machine, and the manner in which the heat is stored for the gas making, it remains to examine the conditions under which the illuminating gases leave the superheater, and the manner in which they are deprived of the heat no longer useful.

The amount of steam introduced into the generator was meaaured, by collecting and condensing it by the aid of snow and ice. It was found that 31.52 lbs. of steam were used for every 1,000 cubic feet of gas made, showing a surplus of 16.16 lbs. over the steam actually dissociated.

The average temperature of the gases at the outlet of the machine, before entering the hydralic main, was found to be 1,616°. (Note P.)

The average temperature of the gases beyond the hydraulic main, after breaking the seal, was 192°, at the inlet to scrubbers the temperature was 183°, and at the outlet of the scrubbers the temperature was 94°. (The scrubbers are located, some before and some after the condensers.)

It is reasonable to suppose that, if the gases leaving the hydraulic main are not saturated with aqueous vapor, no deposition of water will take place until the vapor tension in the mixture corresponds to saturation at the temperature of the point of deposition. It is found that from the mains between the hydraulic main and the inlet of the scrubbers, 4 lbs. of water per 1,000 cubic feet gas made run to the tar wells.

Then, at the inlet of the scrubbers, if the gas is saturated with aqueous vapor, and no other vapors are present, the vapor tension in the mixture is 16.304″ of mercury. (Note Q.) And the volume of 1,000 cubic feet of gas at 60° and 30″, becomes, at the inlet of the scrubbers, 2,707 cubic feet of gas and vapor. The weight of the gas present is, of course, 51.817 lbs. The weight of the aqueous vapor is 56.75 lbs.

Therefore, at the outlet of the hydraulic main, there must have been present $56.75 \times 4 = 60.75$ lbs aqueous vapor, for every 1,000 cubic feet of the final gas. This denotes a saturation of a litttle less than $\frac{1}{4}$. Therefore, at the outlet of the hydraulic main, for every 1,000 cubic feet of final gas at 60° and 430″, there leaves the hydraulic main 2,350 cubic feet of gas and vapor, exclusive of the vapors of tar. (Note R.)

And, at the outlet of the gas machine, for every 1,000 cubic feet of final gas, there leaves the machine 5,310 cubic feet of gas and vapor, exclusive of the vapors of tar.

And, at the outlet of the scrubbers, for every 1,000 cubic feet of final gas, there leaves the scrubbers 1,125 cubic feet of gas and aqueous vapor; the weight of the aqueous vapor present is 2.678 lbs.

The tar is considered to be deposited in the hydraulic main, and to leave the main by the overflow pipe to the tar wells The small quantity carried with the gas will not affect the volume of the gases, nor their temperature.

We have, then, for the condition of the gases before entering the hydraulic main, for every 1,000 cubic feet of final gas, 51.817 lbs. gas, 16.16 lbs. steam, .722 lbs. tar, all at an average temperature of 1,616°.

And just beyond the hydraulic main, the conditions are, for every 1,000 cubic feet of final gas, 51,817 lbs. gas, 60.75 lbs. aqueous vapor, all at an average temperature of 192°.

Table 9 gives the specific heats used. (Note U).

Table 10 gives the specific gravities used. (Note U.)

Computed from the reduction in temperature of the gases from the machine, the loss of heat in transit through the hydraulic main is 45,283 B. T. U.

The gain in aqueous vapor shows the change in the disposition of the heat, the loss of pressure represents the work done by the gases in breaking the seal, the fall in temperature and loss of heat should be the equivalent of the heat carried by the aqueous vapor gained. This is 46,641 B. T. U; 46,641—45,283 = 1,358 B. T. U. This discrepancy (less than 3 per cent) may be due to inexact measurements of temperature, or may be due to the increase in specific heat at high temperatures. The variability of the specific heat is very indefinite.

Between the inlet and the outlet of the scrubbers, 54.072 lbs. aqueous vapor fall to water at 138°, from vapor at 183°, yielding 54,668 B. T. U., and 51.817 lbs. gases are reduced in temperature from 183° to 94°, yielding 2,115 B. T. U. Total heat given up is, therefore, 56,783 B. T. U., for every 1,000 cubic feet of the final gas. (Note S.)

In the condensers, for every 1,000 cubic feet of the final gas, 375 lbs. water were raised in temperature 120°, thus carrying away from the

apparatus 45,000 B. T. U. Then 56,783—45,000 = 11,783 B. T. U., is the heat abstracted by *air* condensation, for every 1,000 cubic feet of the final gas. (Note T.)

The abstraction of heat from a mixture of gases and aqueous vapor, is rendered more difficult by every reduction in the amount of aqueous vapor present.

The notes subjoined give the detailed statements and explanations concerning the results deduced.

NOTE A.—*Table of Corrections for the Effect of Heat on Gas.* The co-efficient of expansion for air and permanent gases, determined by Regnault, for 1° C. was .003666; for 1° F. the co-efficient is $\frac{5}{9} \times .003666 = .002037$. In the column marked "Cubic Feet" are given the amounts of gas which are altered in volume by a change of temperature, by the amounts placed under the degrees.

Cubic Feet.	60 Deg.	50 Deg.	40 Deg.	30 Deg.	20 Deg.	10 Deg.	9 Deg.	8 Deg.	7 Deg.	6 Deg.	5 Deg.	4 Deg.	3 Deg.	2 Deg.	1 Deg.
2,000,000	244,000	204,000	163,000	122,000	81,000	41,000	37,000	33,000	28,000	24,000	20,000	16,000	12,000	8,000	4,000
1,000,000	122,000	102,000	81,000	61,000	41,000	20,000	18,000	16,000	14,000	12,000	10,000	8,000	6,000	4,000	2,000
900,000	110,000	92,000	73,000	55,000	37,000	18,000	16,000	15,000	13,000	11,000	9,000	7,000	5,000	4,000	2,000
800,000	98,000	81,000	65,000	49,000	33,000	16,000	15,000	13,000	11,000	10,000	8,000	7,000	5,000	3,000	2,000
700,000	85,000	71,000	57,000	43,000	28,000	14,000	13,000	11,000	10,000	9,000	7,000	6,000	4,000	3,000	1,000
600,000	73,000	61,000	49,000	37,000	24,000	12,000	11,000	10,000	9,000	7,000	6,000	5,000	4,000	2,000	1,000
500,000	61,000	51,000	41,000	31,000	20,000	10,000	9,000	8,000	7,000	6,000	5,000	4,000	3,000	2,000	1,000
400,000	49,000	41,000	33,000	24,000	16,000	8,000	7,000	7,000	6,000	5,000	4,000	3,000	2,000	2,000	1,000
300,000	37,000	31,000	24,000	18,000	12,000	6,000	5,000	5,000	4,000	4,000	3,000	2,000	2,000	1,000	1,000
200,000	24,000	20,000	16,000	12,000	8,000	4,000	4,000	3,000	3,000	2,000	2,000	2,000	1,000	1,000	.....
100,000	12,000	10,000	8,000	6,000	4,000	2,000	2,000	2,000	1,000	1,000	1,000	1,000	1,000	.....	.....
90,000	11,000	9,000	7,000	5,000	4,000	2,000	2,000	1,000	1,000	1,000	1,000	1,000	1,000	.....	.....
80,000	10,000	8,000	7,000	5,000	3,000	2,000	1,000	1,000	1,000	1,000	1,000	1,000	.....	.....	.....
70,000	9,000	7,000	6,000	4,000	3,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	.....	.....	.....
60,000	7,000	6,000	5,000	4,000	2,000	1,000	1,000	1,000	1,000	1,000	1,000	.....	.....	.....	.....
50,000	6,000	5,000	4,000	3,000	2,000	1,000	1,000	1,000	1,000	1,000	1,000	.....	.....	.....	.....
40,000	5,000	4,000	3,000	2,000	2,000	1,000	1,000	1,000	1,000	.....	.....	.....	.....	.....	.....
30,000	4,000	3,000	2,000	2,000	1,000	1,000	1,000	.....	.....	.....	.....	.....	.....	.....	.....
20,000	2,000	2,000	2,000	1,000	1,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
10,000	1,000	1,000	1,000	1,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
9,000	1,000	1,000	1,000	1,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
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7,000	1,000	1,000	1,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
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1,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

NOTE B.—*Table of Average Outside Temperature for* 1891. Each daily average is the mean of 24 hourly observations. The average for the year, 50.7° F., is the mean of more than 8,700 observations. The thermometer hung on the north wall of the meter house—the works office building.

Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	31	43	18	38	52	62	67	69	61	54	46	32
2	42	34	15	40	59	73	67	69	65	61	36	39
3	26	37	29	41	52	59	69	69	70	63	33	39
4	24	16	29	39	53	47	66	68	71	66	35	45
5	25	22	23	35	43	59	68	68	64	62	39	44
6	22	35	28	37	46	62	66	69	63	57	39	47
7	25	36	34	37	48	62	70	75	63	59	43	44
8	26	25	34	40	59	71	67	72	61	55	40	35
9	26	30	41	39	51	73	62	71	60	50	43	42
10	30	33	31	45	60	70	68	80	64	53	49	45
11	42	25	36	50	66	78	70	79	67	48	56	41
12	35	32	41	52	48	76	69	82	67	50	49	38
13	22	31	45	53	53	72	79	70	70	50	42	44
14	32	14	30	62	61	79	79	73	66	54	41	41
15	29	27	30	42	53	84	77	67	63	56	35	35
16	29	46	33	50	56	87	75	64	62	50	53	33
17	28	40	24	53	48	61	73	71	67	48	50	16
18	30	36	39	66	51	53	75	73	78	53	30	26
19	25	27	38	65	55	58	76	67	65	54	32	32
20	29	31	36	50	66	60	75	73	64	52	39	34
21	36	37	38	55	67	69	72	79	69	49	43	37
22	44	31	43	66	67	64	69	74	66	46	47	46
23	37	28	41	59	51	67	70	70	68	38	54	49
24	37	45	41	47	59	66	71	81	69	39	44	39
25	30	54	37	41	63	68	74	78	75	40	39	39
26	31	35	32	48	61	69	67	69	68	53	39	45
27	30	24	35	63	55	62	67	67	67	45	41	32
28	34	31	39	54	60	63	72	67	73	37	36	30
29	37	.....	43	45	53	66	65	65	71	40	19	44
30	39	.....	39	55	65	62	64	59	58	54	21	34
31	36	.....	38	.....	62	.....	63	60	.....	58	.....	25
Average....	31	32	34	49	56	67	70	71	67	51	40	38

NOTE C.—The naphtha is assumed to be of the following composition by weight:

C.....	84.00
H.....	16.00
	100.00

Then, for every 1,000 cu. ft. final gas, there enters the oil retort, in the form of naphtha and vapors:

28 × .84 = 23.52 lbs. carbon.
28 × .16 = 4.48 lbs. hydrogen.

And the total carbon used in the gas machine, for every 1,000 cu. ft. gas

made, is 47.41 lbs. The symbolic formula corresponding to the above assumption regarding the naphtha composition is $C_7 H_{16}$—heptane, specific gravity = .6967 for one of nine isomeric compounds.

NOTE D.—Although no account has been here taken of the oils deposited in the purifying boxes in saturating shavings and purifying material, when it is further considered that the volume of the gas made was measured at a temperature lower than 50°, it will be seen that .722 lb. of tar per 1,000 cu. ft. of gas at 60° is a fair basis for further consideration. If this tar is composed in the proportions, by weight, of—

C	86
H	14
	100

there is regained at the tar wells, from the coal and oil put into the machine, the following weights:

Carbon	.621 lb.
Hydrogen	.101 lb.

NOTE E.—*Table 3.—Average Analysis of the Final or Holder Gas.* It is assumed that the illuminants are made up of the gases bracketed, as shown.

Gas.	By Volume.		By Weight.		Specific Weight.		By Weight. C.	By Weight. O.	By Weight. H.	By Weight. N.	Specific Heat.
CO_2	3.2		7.23		4.893		1.972	5.258	....	.....	.0157
C_2H_4	7.4	14.8	10.59	33.28	7.164	22.514	9.072	.....	1.518	.....	.1331
C_3H_6	3.7		7.94		5.373		6.804	.....	1.136	.....	
C_6H_{12}	3.7		14.75		9.977		13.608	.....	1.142	.....	
CO	25.8		36.90		24.968		15.814	21.086	.....	....	.0904
CH_4	17.2		14.07		9.518		10.545	.....	3.525	.....	.0834
H_2	35.6		3.64		2.467		.....	.....	3.64	.....	.1241
N_2	3.4		4.88		3.303		.....	.....	.....	4.88	.0119
	100.0		100.00		67.663		57.815	26.344	10.961	4.88	.4586

NOTE F.—*Table 4.—Weight, by Elemental Parts, of 1,000 Cu. Ft. Dry Holder Gas.*

Carbon	29.958 lbs.
Oxygen	13.651 "
Hydrogen	5.680 "
Nitrogen	2.528 "
Total	51.817 lbs.

.07658 × .67663 × 1,000 = 51.817

NOTE G.—For the steam dissociated (x).

15.96 : 13.65 :: 17.96 : x.

x = 15.36, and the hydrogen = 1.71 lbs.

NOTE H.—*C., H., and O. Used—*

	C.	H.	O.
From Coal	23.89	....	....
" Oil	23.52	4.48	....
" Steam	....	1.71	13.65
Totals	47.41	6.19	13.65
Recovered—			
Holder Gas	29.958	5.68	13.651
Tar	.621	.101	....
Totals	30.579	5.781	13.651
Hence, used on blast.	16.831	.409	

NOTE I.—It will be observed that 2.157 lbs. carbon, and .409 lbs. hydrogen are in the relation by weight in which these elements are contained in naphthas.

NOTE J.—*Table 5. Average Composition of Air.* (Ganat)

	By Volume.	By Weight.
Nitrogen	78.49	76.53
Oxygen	20.63	22.89
Aqueous Vapor	.84	.52
Carbonic Acid	.04	.06
	100.00	100.00

NOTE K—*Table 6. Average Analysis of Waste (blast) Gases.*

	By Volume.	By Weight.	Sp. Weight.	By Weight. C.	By Weight. O.	By Weight. N.
CO_2	17.75	25.35	27.142	6.91	18.44	....
CO	2.8	2.53	2.710	1.08	1.45	....
N_2	79.45	72.12	77.194	....	....	72.12
	100.00	100.00	107.046	7.99	19.89	72.12

NOTE L.—From Table 6, it appears that of 100 parts of waste gases, 19.89 parts, by weight, are oxygen, the nitrogen (as from air) equivalent to this amount of oxygen is 66.5 parts.

$$19.89 : 22.89 :: y : 76.53 \qquad y = 66.5$$

But the nitrogen appearing is 72.12 parts; therefore 5.62 parts are from air the oxygen of which has combined with hydrogen, and fallen to water. The hydrogen thus accounted for is .21065 parts.

$$\frac{5.62 \times 22.89 \times 2}{15.96 \times 76.53} = .21065$$

But 16.831 lbs. carbon are burned from the machine on blast; therefore, .4437 lbs. hydrogen are so burned.

$$\left(.21065 \times \frac{15.96}{2}\right) \times 16.831 = .4437.$$

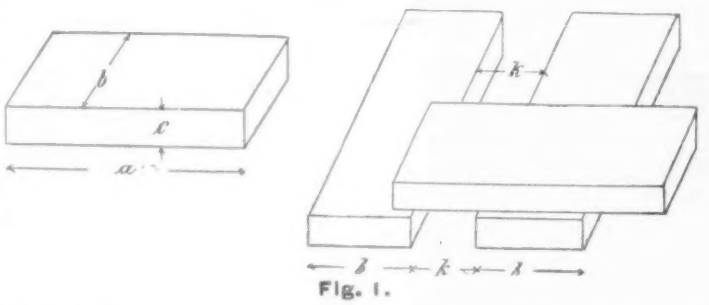

Fig. 1.

NOTE M.—(See Fig. 1.) If a = length, b = width, c = thickness, and k = distance between tiers, then, at Calf Pasture Works,

$$a = 2b = \frac{18}{5}k. \qquad b = \frac{9}{5}k. \qquad c = k.$$

And, laid in straight tiers, the surface of contact =

$$2ac = \frac{36}{5}k^2.$$

Laid in crossed tiers, the surface of contact =

$$2ac + bk\left(\frac{a}{b+k}\right) = \frac{333}{35}k^2.$$

The increase is

$$bk\left(\frac{a}{b+k}\right) = \frac{81}{252} = 32.1 \text{ per cent.}$$

(See also Figs. 3, 4, 5, and 6, on following page.)

NOTE N.—*Table No. 7.* Total area of full valve opening, 1,000; each rise of valve stem = .05 of diameter of valve. (See Fig. 2.)

Part.	Areas of Increment. Area.	Total Valve Opening. Rise of Stem.	Total Valve Opening. Area.
A	63.4	.05	63.4
B	63.1	.10	126.5
C	63.1	.15	189.6
D	62.7	.20	252.3
E	62.0	.25	314.3
F	61.3	.30	375.6
G	60.3	.35	435.9
H	58.8	.40	494.7
I	57.4	.45	552.1

J.....	55.7	.50	607.8
K.....	53.6	.55	661.4
L.....	51.4	.60	712.8
M.....	49.0	.65	761.8
N.....	46.2	.70	808.0
O.....	43.3	.75	851.3
P.....	40.2	.80	891.5
Q.....	36.6	.85	928.1
R.....	31.7	.90	959.8
S.....	26.1	.95	985.9
T.....	14.1	1.00	1000.0

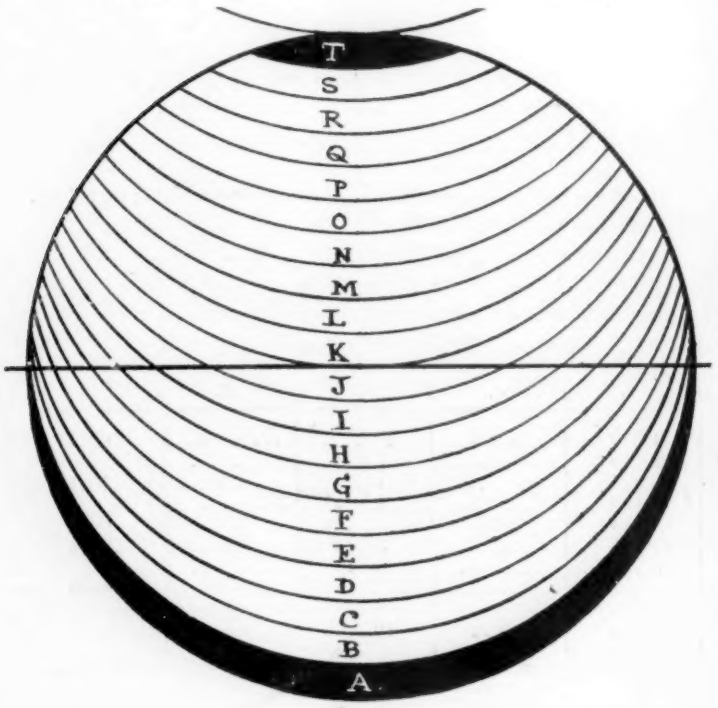

Fig. 2.

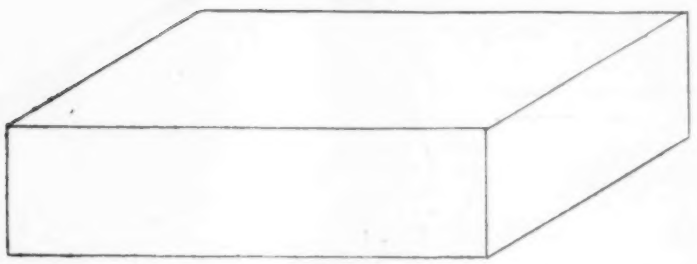

Fig. 3.

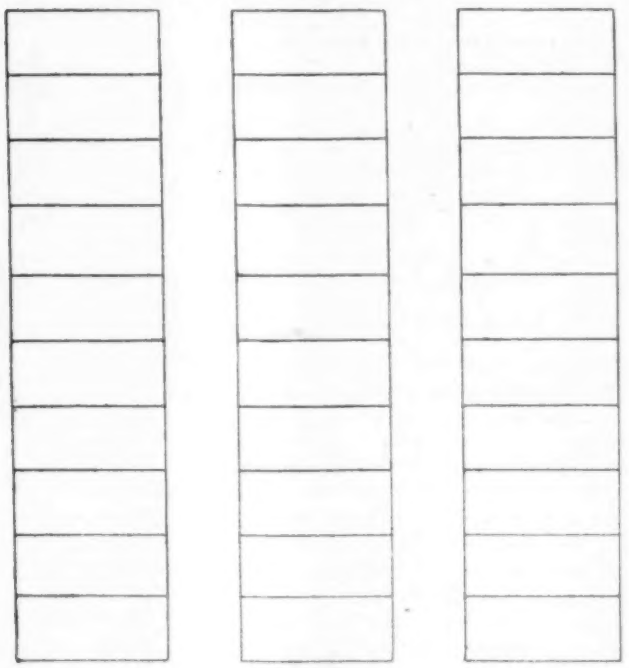

Fig. 4.

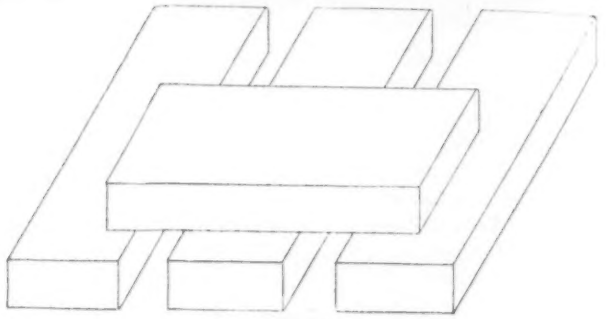

Fig. 5.

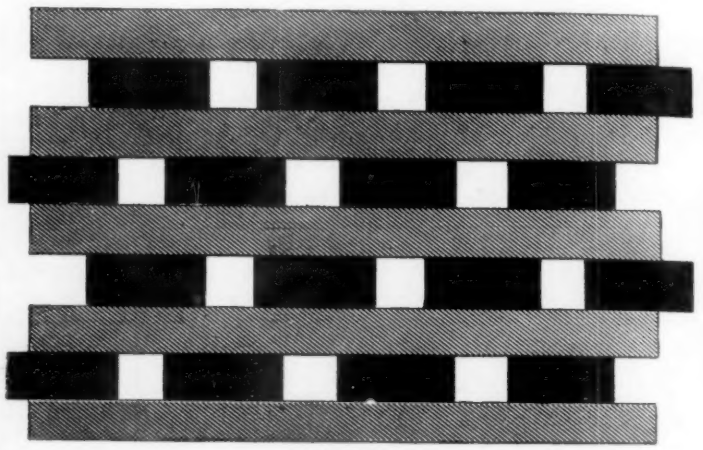

Fig. 6.

NOTE O.—*Table* 8. Total volume of brick, 10,000. (See Fig. 7.)

Axial Fraction of the Brick Destroyed or Impaired.	Volume of Impaired Portion.	Volume of Unimpaired Portion.	Volumetric Increment.
.05	1.25	9,998.75	1.25
.10	10.00	9,990.00	8.75
.15	33.75	9,966.25	23.75
.20	80.00	9,920.00	46.25
.25	156.25	9,843.75	76.25
.30	270.00	9,730.00	113.75
.35	428.75	9,571.25	158.75
.40	640.09	9,360.00	211.25
.45	911.25	9,088.75	271.25
.50	1,250.00	8,750.00	338.75
.55	1,663.75	8,336.25	413.75
.60	2,160.00	7,840.00	496.25
.65	2,746.25	7,253.75	586.25
.70	3,430.00	6,570.00	683.75
.75	4,218.75	5,781.25	788.75
.80	5,120.00	4,880.00	901.25
.85	6,141.25	3,858.75	1,021.25
.90	7,290.00	2,710.00	1,148.75
.95	8,573.75	1,426.25	1,283.75
1.00	10,000.00	.00	1,426.25

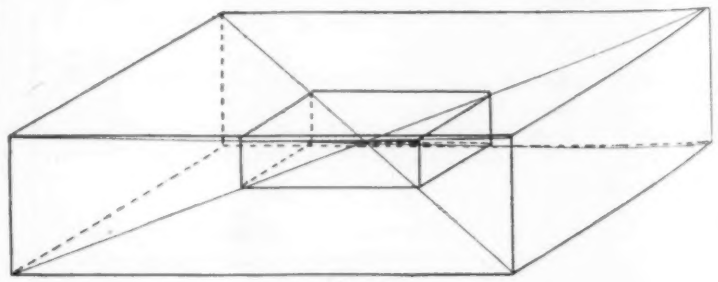

Fig. 7.

NOTE P.—The determinations of the temperatures of the blast gases and of the illuminating gases, at the outlet pipes of the gas machine, were made by J. F. Wing, Assistant Superintendent, using the formula $H = .105907\,t + .00003269\,t^2 + .000000022159\,t^3$, where H = calories to raise 1 lb. iron from 0° C. to t° C.

NOTE Q.—The tension of aqueous vapor for different temperatures of saturation is taken from the tables of Rev. Robt. Dixon.

NOTE R.—The relation between the conditions of a gas under varying circumstances is expressed by the formula

$$V\,P\,(1+\alpha\,T) = V'\,P'\,(1+\alpha\,T'),$$

where V = volume,
P = pressure,
T = temperature,
α = co-efficient of expansion.
Absolute zero = $-461.2°$ F.

NOTE S.—Of the total heat abstracted by the scrubbers and condensers only $\frac{2,115}{56,783} = 3.7$ per cent. is from the gas.

The greater portion, or $\frac{54,668}{56,783} = 96.3$ per cent., is from the aqueous vapor falling to water.

NOTE T.—In the scrubber house the heat abstracted by the condenser water is $\frac{45,000}{56,783} = 79.25$ per cent.; and the abstraction of heat by air condensation is $\frac{11,783}{56,783} = 20.75$ per cent. of the total.

NOTE U.—*Tables 9 and 10.* (Mainly from Regnault.)

Gas.	Specific Gravity.	Weight of 1 Liter (at Paris 0° C. 760 mm.) In Grammes.	Weight of 1 Cu. Ft. at 60° F. and 30" P. In Grains.	In Pounds.	Specific Heat. Equal Volumes.	Equal Weights.
Air (dry)	1.0000	1.293187	536.06	.07658	.2375	.2375
O_2.....	1.1057	1.429802	592.7	.08467	.2405	.2175
H_2.....	.0693	.089578	37.15	.0053069	.2359	3.4090
N_2.....	.9714	1.256167	520.7	.07439	.2368	.2438
CO_2.....	1.5291	1.977414	819.7	.1171	.3307	.2169
Aqueous vap.	.6225	.....	333.7	.04767	.2984	.4805
CO.....	.9678	.....	.....	.....	.2370	.2450
CH_4.....	.5534	.....	.....	.....	.3277	.5929
C_2H_4.....	.9681	.....	.....	.....	.4160	.4040
C_3H_8.....	1.452	.....	.....	.....	.....	.....
C_6H_6.....	2.696	.....	.....	.....	1.0114	.3754

NOTE V—*Atomic Weights.* (Winkler and Lunge.)

Carbon	11.97
Oxygen	15.96
Hydrogen	1.00
Nitrogen	14.02

Discussion.

The President—You have listened to a very instructive and exhaustive paper; and the matter is now before you for discussion.

The Secretary—I would like to enquire more particularly about the method of filling the superheater. I notice Mr. McKay recommends that the superheater be filled with bricks laid crosswise, in order to preserve the heat?

Mr. McKay—When the tiers are laid directly up, without crossing, the gases from the generator and secondary air have very little friction, and very little opposition to their passage directly into the atmosphere. But when the tiers have been crossed and recrossed, the flame is driven directly against the surface and must be deflected from it at right angles before it can ascend further. Referring to this figure, if one layer of bricks is laid in tiers, running in any given direction, and the next layer is crossed, then all the blast gases coming up here strike the under surface of one brick and are deflected the length of the other brick below, and then again at right angles, before they can come up by the depth of the brick; and with every depth of brick that deflection continues. So that there is a very great increase in the surface of impact in one case, whereas in the other case there is no surface of impact; there is only a surface of contact. In the latter case the gas comes in at the bottom of the superheater, and goes right up; whereas in the first case the gas strikes the brick and is deflected continually.

The Secretary—Is there not a saving of fuel by laying them crosswise?

Mr. McKay—The saving of fuel is represented by the extra heat abstracted from the gases. In other words the practical effect of this is to greatly increase the capacity of any setting. With the same amount of coal burned a great deal more gas is made; otherwise you would perhaps burn as much coal, but you would not make as much gas. The heat would be thrown into the air unutilized.

The Secretary—Then there is a saving of fuel?

Mr. McKay—There is a saving of fuel, and a great increase in the capacity of the machine.

The Secretary—I ask these questions because in our first setting of a water gas apparatus it was said by the U. G. I. Company that the bricks were to be laid closely together; but I find that in putting in their second sets they are laying them much more openly. I was trying to get at the distance which it is advisable to separate them and so combine the two systems.

Mr. A. C. Humphreys—I was quite at a loss to understand Mr. Prichard's question, because the practice of Mr. McKay as shown there is our practice, and I am not aware that our men are changing the practice. If so they are doing it against orders. The only change would be in the spacing of the brick, which is an entirely different thing.

The Secretary—I understood him to allude to the spacing. I see that I was mistaken.

Mr. A. C. Humphreys—Mr. McKay has not touched upon the question of spacing at all, whether it should be 1½ inches or 2 inches, or whether there should be a variation between the bottom and the top of the superheater. I think it is only just to the Boston engineers to draw their attention to the fact that the paper makes a misstatement at the outset. The apparatus is referred to as a Flannery set. Most distinctly it is not a Flannery apparatus. A Flannery apparatus would be carried out in the lines that Mr. McKay condemns. The gentlemen in Boston have found that in the mechanical working the design may be changed. The Flannery apparatus as it was patented, and as it was very strenuously stuck out for by Mr. Flannery, was a system of bridge walls built upon a system of arches, and the gas as it came down upon the top of generator came down through three interior gas conduits to the bottom of the arch, and found its own way into any one of these channels. It might take its way through them all, or might take its way through part only. Whichever way presented the least line of resistance of course was the way the gas went. The consequence was that the gas was not properly fixed. A change has been made, and I think that the Boston engineers do themselves injustice in continuing to call it the Flannery apparatus. There is no question at all about Mr. McKay's point as to the staggering of the brick. I had a case where the apparatus had been guaranteed by the agent beyond its capacity, and I had some difficulty in getting up to the capacity of the machine. I felt sure though it could be done. The agent had guaranteed it up to a point pretty near its limit. I made a number of visits to the place myself, but failed every time to make the guarantee. I repeatedly asked the man in charge if he had the bricks in the superheater so as to break joints, *i. e.*, "staggered." I was told, "yes." On my third visit I made an examination and found he had them placed as shown by the Flannery drawing. We made a change at once, and there was a gain of 30 per cent.—and it exceeded the guarantee. It hardly takes any demonstration to show that this should be the result. Mr. McKay's argument shows it plainly. He shows what the reason of it is and what a perfect reason it is. There is a continual baffling all the way up. There may be 35 lineal feet of baffling in our superheaters; and it stands to reason that the contact with the hot surfaces must be much more efficient. Something has been said in regard to the closing of the brick by deposits of hydrocarbon. I am not quite sure that I caught the point in full, and I would like to ask if at Mr. McKay's works they practice during the idle hours leaving the apparatus on a light or natural draft and carry on a slight secondary combustion in the superheater to clear out the deposits, so that you do not have to depend upon the conditions under active blast when you must turn on your make again at a certain time because your heats on the surface require it.

Mr. McKay—Taking up the first question, as to the original laying of the Flannery superheater, I have to say that Mr. Humphreys states correctly the manner in which we laid up the tiers at first. But we found in practice immediately that we were carrying a greal deal of heat out of our superheater stack. I am inclined to believe (of course I do not know it, for I never had the pleasure of meeting the late Mr. Flannery) that the reason he adhered to this manner of laying up the superheater bricks was because at one time there was a great deal of trouble with the deposits of hydrocarbon lampblack, or a black powder in the superheater, which choked up the passages of the superheater; and sometimes the circular firebricks in the superheater, which were laid to have different points of contact, would become so badly fouled that the whole machine would have to be thrown out of service, and all the bricks changed and cleaned out. But in this arrangement of brick [referring to straight tiers] such a deposit could never take place, because all lampblack and dust would be driven out by the force of the current of gases. On the other hand, this arrangement of bricks never gets all of the heat out of the gas. So that there is a mean between those two extremes in the arrangement of bricks—as to how long they can be run without stoppages—and that regulates the distance between the tiers. Referring to the matter of tar, I will say that in one of the notes to this paper (which I have not read, as I understood it could be as well inserted af-

terwards) I have given the formula in accordance with which we suppose the combustion of tar can be carried out. This is by weight: Carbon, .86; hydrogen, .14. In gallons the tar for December, 1891, and January, 1892, was 16,650 gallons, corresponding to a weight of 138,711 lbs. Our tar is very nearly on an average the weight of water. Some of it is above and some below water. In other words, some of it more resembles a lighter liquid hydrocarbon; and the other part sinks to the bottom of the tar as well as below the surface of the water. Then, again, we have another substance which floats between the water and the tar. The average specific gravity of the tar is very nearly that of the water. There was one other point that Mr. Humphreys asked me about, but which I have forgotten.

Mr. A. C. Humphreys—About the slow combustion.

Mr. McKay—We do leave our machine on natural draft when not in service; and the practical advantages of the natural draft are very marked. With the machine on natural draft, and not in service, we find on opening up it very often shows that the grate bars, which are of wrought iron, or the grate rests, which are of cast iron, have been rather highly heated. It requires very close attention on the part of the gas maker to keep the heats at a point which will not interfere with the condition of the fires in the generator, and which will also continue the combustion of the gases in the superheater. We also find that the combustion which is affected by the supply of air while the machine is on natural draft is hardly sufficient to effect any appreciable change in the condition of the superheater bricks. It requires a very large excess in the supply of secondary air in the machines to clear out the superheater chambers. When we open up our machine and remove the superheater bricks to renew them, we never find on the outside bricks any sign of carbon deposits; but upon breaking a brick open we sometimes find that while the outside surface of the brick, and perhaps half, or three quarters of an inch, or an inch in from the outside surface along each of the axial dimensions, is just as good as when it was put in, yet the heart, and from the heart outwards, has been entirely carbonized, as it is termed, or choked up with this deposit. After this machine had been used for the long time stated (making 150,000,000 cubic feet of gas before the bricks were changed), the admission of secondary air was found then so to have increased the total supply of air to the machine that there was an excess of air (as shown by analysis of gases at the superheater stack) of from 20 to 26 per cent.; and it is upon that excess of air that we depend to keep the surface, and just below the surface of the bricks, free from carbon deposits. We do not have to depend upon the supply of air during natural draft, although we do depend upon the air supply during natural draft to maintain the heat of the whole machine at such point that it will be ready for almost immediate operation.

Mr. Neal—What is the yield of tar per 1,000 cubic feet of gas made? And, is that tar merchantable? Has it the value of coal gas tar?

Mr. McKay—I am sorry I have not complete data with me, either of the tar we make or of the superheater brick. In reply to the question as to the quantity of tar per 1,000 cubic feet of gas, by weight, I may say that it is .722 pounds. This is the average for the make of gas of nearly 190,000,000 cubic feet. As to whether it is merchantable or not, I may say that we are disposing of it, but that we met with difficulty in the separation of the tar and in entirely clearing it of water. We have an efficient apparatus in service now, and we also undertook the manufacture of pitch, but merely experimentally, and in small quantities. We found that by the combustion of the hard tar itself we could so increase this as to make of it an excellent pitch.

Mr. Neal—I asked this question, because I would like to know whether it would be worth while for my company to save the tar. I have never saved any of the tar from the water gas works. I, of course, did not allow it to run into the tank where the coal gas tar is stored, because I think it would injure it very much; still, if it is of any value, I think it would be worth while to save it. I have never learned from any one that it was of much value, because of the trouble which you speak of that it has to be worked over to some considerable extent. Of course this paper is not so interesting to some of our friends who are only making coal gas, but it is very interesting to me, and I presume it is to all who are making water gas. In speaking of the laying up of the brick in checker work in the superheater, I may say I think the more effective the superheater is the more likely it will be to choke up. I tried using crude oil, but the chamber of the superheater became clogged very soon, and so I used naphtha. Mr. Humphreys sent me on a plan by which I could use crude oil, but I have not applied it as yet.

Mr. A. C. Humphreys—I would like to ask Mr. McKay if he ever tried keeping the secondary blast on while the fires were banked, and practically having no draft going on the generator at all? Some of our men will, perhaps, slide in a small piece of tin between a door, and have, perhaps, an inch pipe opening into the superheater, so that there is always a large excess of air going to the superheater, and consequently the carbon is deposited on the brick, and supplies the fuel to consume itself while keeping the superheater hot. I think you would find a material difference if you have not tried that. I would also like Mr. McKay to state the kind of oil he uses. Of course the kind of oil at once comes in in considering the tar question. With regard to the separation of tar and water, I would like to ask him whether it is merely a mechanical separation. I think the paper read at the last meeting of the American Association on oil tar is very instructive, and I would recommend Mr. Neal to read it.

Mr. Neal—I heard it read.

Mr. A. C. Humphreys—There is nothing in it which is not practical. We consider that oil gas tar or water gas tar is really more valuable, when once separated, than is coal gas tar. In works in the West where they are running coal and water gas together, both kinds of tar go into the same tar well, and a gradual separation is effected by the heavier coal tar, which takes hold of the oil tar and holds it. So that where there has been perhaps 40 per cent. of water in the water gas tar in the mixture, there will not be over 20 per cent. after a short time. This makes the problem a very much simpler one to solve. In your case, I understand that you have the tar in the condition of an emulsion—a very intimate admixture. I strongly recommend gentlemen who are making water gas, not to throw away their oil gas tar. If they cannot do better with it, they can partially separate it from the water and use it as fuel. It certainly is throwing away money to throw away the tar. It is well to draw attention in this connection, to the fact that what Mr. Neal is referring to is the Granger setting, which is specially adapted to the use of naphtha. Before sitting down, I want to say that this is one of the papers that it is almost impossible to do justice to in any discussion. It seems to have been most carefully prepared, and I have no doubt that all who are interested in this business will give careful consideration to it hereafter. I think that Mr. McKay deserves great credit for its preparation. I do not remember ever to have listened to a more carefully prepared paper.

Mr. Lamson—I think this paper of Mr. McKay's deserves very strong commendation upon the part of the Association, and that he ought to be especially thanked for the preparation of it—although, I have no doubt, the study of the whole thing has been a great pleasure and satisfaction to him, and so, perhaps, has got his own reward out of it; but I am sure that his Company will be benefited by his careful study. I think the Association ought to be particularly thankful for a paper like this. I know that other members have spoken and enlarged upon the fact that, in the business of electric lighting, there are many men of education who are making the electric light, and the inventions pertaining thereto, a careful study; and the rapid increase of that business is largely due to the brain work, to the careful thought and study given to the various matters pertaining thereto. Here is one case in which careful brain work is put into the study of the gas business; and such study as this would bring the gas business up as fast as the electric light business. I think we voted last year to have all the papers printed before the meeting; and I regret that it has not been done in this instance. If such a paper as this could have been printed in time to be passed around among the members and examined while the paper was under discussion, we should have received more benefit from it than in any other way. Some members here will doubtless examine this paper after it has been printed in the papers, and will derive great benefit from it. But that number will, perhaps, be small in comparison with the whole number of members of the Association. If we had the paper right before us, I think we should all have understood the subject much more thoroughly. I would like to know from the Secretary whether it was not ordered at the last meeting that the papers be printed?

Mr. McKay—In reply to Mr. Humphreys' question regarding the composition of the oil that we use, I would say that the specific gravity of it averaged for the time of the test 70°, Beaume. It was a very light, high and fine grade of naphtha. This (as will appear in a note to this paper, which I have not read) is considered to be composed in the proportion by weight: Carbon, 84; hydrogen, 16. This compound has nine isomeric forms, many of which are not known, but this is the normal condition of the average run of naphtha of the grade I have referred to. I am very glad to learn regarding the opening of the superheater blast valve. Our natural draft has been admitted to the gas machine only by opening the doors on the machine which had no connection with the blast pipe. Frequently we entirely shut down our works (in fact every Sunday, during the day), so that at that time, unless we keep our blowers purposely running, we could not admit air under forced blast. I suppose that by admitting air under pressure to

the superheater, and by diminishing the amount of air admitted to the generator, we have precisely the condition of affairs which exists when the machine is on blast, except in a very minor degree. The total amount of air going in is very much less. It is not distributed in the same way between the generator and the superheater. In other words, the carbon for the continuation of the combustion in the machine on natural draft would be that in the superheater under these conditions. Under ordinary conditions it would be the carbon in the generator.

Mr. A. C. Humphreys—I would suggest to Mr. McKay that the condition of time enters there; and that, as he well knows, is a very material element in all chemical operations. You know how it is in purification. You cannot simply take the relative proportions of work that you have got and give the chemical action without considering the time of the work.

Mr. Sherman—I would like to ask Mr. McKay how many pounds of coal he uses in his generator, not including the ashes. He stated 29 pounds, less the ashes.

Mr. McKay—The carbon from the coal is 23.9 pounds of carbon consumed. The figures for the whole amount I have not given, but from what we take from our generators we get screenings sufficient, or nearly sufficient, for running the entire steam plant of the works. The boiler fuel not thus supplied we get from the coal dust of our anthracite coal pile.

Mr. Sherman—In other words, you run 29 pounds of coal into your generator?

Mr. McKay—No; we burn from our generator in making gas 23.9 pounds of carbon—nearly 24 pounds.

The President—Before we close the discussion it might be interesting to hear from some members in regard to whether they have utilized tar, or saved it for any purpose. Can Mr. Lamson answer?

Mr. Lamson—We are experimenting with it all the time. We have not yet got any money from it. We have tried to sell some. We sent quite a lot of it to Mr. Cabot, who said that if we improved it and freed it from water he would be willing to buy it. We have not yet got in such a condition that we can get any money out of it, but we hope to do so. I think that the Boston Company, at the Bay State Works, have been making experiments, and claim that they have got the tar into such condition that they can dispose of it. Very likely Mr. McKay can tell us about that.

Mr. Neal—Is naphtha used exclusively for enriching at your works?

Mr. McKay—We use naphtha entirely. The Flannery setting is much better adapted for the use of naphtha than for the use of any other enricher. Mr. Humphreys has asked as to the manner of the separation of the tar. We pump our tar, and sometimes, as it appears on the surface of the tar well, almost free from water. After manipulating the liquors for some time, the workman can tell by his eye very nearly the condition of the tar. If it is sufficiently free from water for barreling direct, or to put directly into barrels to be shipped to lampblack manufacturers, it is done. But in case of tar containing a large percentage of water, we pump it into a large tank that holds, when full, 16,000 gallons. Near the bottom of this tank there is a very large steam coil. Steam is introduced into this coil under boiler pressure—the condensed steam being carried away as quickly as formed; and in this way the whole contents of the tank are raised nearly to the full temperature of our boiler pressure steam. In this condition, while some of the light vapors in the tar are thrown off and carried out, sometimes into the air and sometimes back into the scrubbers (for we have an arrangement for carrying the light vapors back to our gas), yet the total result of a long heating and (the steam being then shut off) of the thorough cooling, is that the tar, which is heavier than water, is at the bottom of the tank—the water is above this layer of tar, and above the water are the lighter oils. The lines of demarkation are very distinctly drawn, and, owing to the large volume of our tank, the men engaged in barreling have no difficulty in barreling clear tar, and in running off the clear water, and in then barreling the lighter refuse.

The President—Has Mr. Sherman derived any income from the sale of water gas tar?

Mr. Sherman—No; and I would like some one to tell me how I can get a dollar out of it. I have spent a good deal of money in experimenting. I sent some of the tar down to Mr. Cabot, but he don't want any more.

Mr. A. C. Humphreys—I will say that all purchasers of tar will take that position if you will let them, because the tar that was first sent them caused them trouble for the reason that they did not know how to handle it advantageously. But I think we have now educated them, in the West at least, out of their opposition. Here in the East it is hard to get rid of tar anyway.

Mr. Lamson—What do you get for it in the West?

Mr. A. C. Humphreys—I would not dare to tell you.

Mr. Lamson—I sold tar at $5 per barrel last summer.

Mr. A. C. Humphreys—We sold it for just about the same price in the West.

Mr. Lamson—Do you say that you do not know what the price is there?

Mr. A. C. Humphreys—No. The tar of water gas itself is unquestionably for many purposes of better quality than coal tar. It is more elastic. It is better for paint making. Of course the buyers of tar have their own methods of handling tar, and do not change them readily—I know in certain cases that they are getting oil tar and make no objection; but generally the objection is made where it is mixed with coal tar, or contains a lot of water. If Mr. Sherman will take the trouble to rig up an apparatus for separating I think he will find it to his advantage. When he can furnish purchasers with the clear tar he will find that the demand will be all right, and he will be able to get rid of it. If he cannot do any better, he can burn it under the boilers. That is what we did in the first place and before we got down to the separation. I think we ought all to understand that any modern apparatus ought not to make tar if naphtha is used; or it ought to be practically so small an amount that it would be simply a question of drainage in getting rid of it.

Mr. Nettleton—I would like to ask Mr. Humphreys if the water gas tar is used for the same purposes that coal gas tar is ordinarily used for. With us in the western part of Connecticut, and I think largely through New England, coal tar is used largely for the manufacture of sidewalks. Is the oil tar used for that purpose?

Mr. A. C. Humphreys—Yes; the oil tar is used for the manufacture of walks. I would refer Mr. Nettleton to the paper of Mr. Douglas on this subject, and I think it will pay all of you to read it. I will say that that paper was first prepared as a report to me at one of our annual meetings of superintendents, and it was afterwards turned into a paper for the American Association, under a stress for papers. I am not sure whether that preliminary work of his was for walks or not, but he certainly did make walks with the tar, and then gave that use up because he found better outlets for it. He took contracts himself for making walks, and met with considerable success.

Mr. Nettleton—Is it now sold in the West for the purpose of making walks?

Mr. A. C. Humphreys—I do not know what they use it for, but I think chiefly for paints, and for the saturation of paper, etc. Of course we do not know anything about the secrets of their trade.

Mr. Sherman—I think Mr. Harbison can give us some information with regard to the sale of water gas tar.

Mr. Harbison—We have not had any practical difficulty in disposing of all the water gas tar we have made. We sold it last year at $1.50 per barrel—all that we tried to sell. We are selling now at the same rate. We have been quite successful in using it for concrete walks around the gas works. We found it also of very great value for painting the buildings 2 or 3 feet above the ground to keep out the dampness. We have also found it of great value in painting gas holders, and all iron work—very much better than any paint we could obtain. The prospect is that we shall perhaps go on to the use of naphtha instead of crude oil, and then not make much tar. I find that those who have used it say that it works well for concrete walks when it is mixed with coal tar. It requires but little ingenuity on the part of a competent manager to dispose of all the tar that he makes in a profitable manner.

Mr. W. A. Wood—I would like to ask Mr. Humphreys whether he considers the amount recovered—which I understood Mr. McKay to state to be .7 pound per 1,000 feet—to be abnormal. My recollection of Mr. Douglas' figures is that it was something like 4 or 5 pounds per 1,000 feet.

Mr. A. C. Humphreys—It is a question of machines and of material. Mr. Douglas was then referring to one of the oldest settings (which he still is using), and not to a modern setting. He was then using crude oil; and with crude oil we expect to get .3 of a gallon per 1,000 feet of gas. By crude oil I mean the Lima crude; and also the heavy oil, such as the intermediate of 28°.

Mr. Neal—How much with the naphtha enricher?

Mr. A. C. Humphreys—I do not think you would get any with the modern apparatus. When I say "modern" I mean apparatus right up to date.

Mr. Neal—Such as the Granger, for instance?

Mr. A. C. Humphreys—That is not just to the Granger folks, for I

have seen the Granger apparatus run right along without getting any tar. Mr. Robert Young will tell you he can run his Granger apparatus so that he can wash his hands in the seal ; but that is very careful running.

On motion of Mr. Lamson a hearty vote of thanks was tendered to Mr. McKay for his very able and interesting paper.

(To be continued.)

What it Costs to Learn Engineering.

A correspondent having asked the above question of the editor of *Invention*, our contemporary made the following reply thereto :

The question is a very hard one, indeed, to answer, for all men are not adapted to learning the business ; for although it may appear easy to the observer, the practice of engineering means hard work, close attention, considerable bother, frequent discouragements and a great deal of study, and at the last the business is not thoroughly learned, for life is too short for a man to learn all there is to be learned in practical steam engineering. A man or boy who has an aptitude for learning and a desire for the business can learn enough to make himself quite practical at it in a length of time depending on the attention he gives to the subject and his facilities for learning.

The principles of steam engineering do not include such a vast array of facts that it should deter any one from an effort to master them, but the degree of success with which they attain the knowledge depends a great deal on the way they go at it. The practical part of steam engineering must be learned in the engine room, and we do not know of any better method of obtaining a good practical knowledge of the business than by going to work in the fire room for a good engineer. Here a man or boy can make himself useful and note the operation of things, and will have a chance to learn the principles involved ; but the practical knowledge of them can be obtained only through long practice with the apparatus. While in such a position, if the young man will pro cure some good work on steam engineering and study the principles from that, he will gain a better insight into the business in the same length of time than he would be able to obtain in any other manner that we are familiar with. The engine itself is generally the point of interest to the would-be engineer ; but it by no means comprises all that is of interest or all that is necessary to be learned in order to be an engineer.

Most works on engineering give descriptions of different kinds of boilers, and the boiler is that part of the machinery that requires considerable attention and frequent investigation to know that it is in safe condition, and not only this, but a great deal of fuel can be wasted in producing the steam necessary for driving the machinery, and the engineer must reduce such waste to the lowest point. There are books on steam engineering that will show clearly the construction and operation of the different parts. When these are mastered, one essential part of the business is gained, and such knowledge will enable him to talk with some degree of satisfaction with those who are better posted on the subject, and in this way he will be able to pick up many valuable points in the business, as well as having his attention called to such points as he has overlooked. He will always find that there are a large number of these. If the student will refer to his books for the rules that apply to each part of the business that he becomes acquainted with, he will find his progress quite rapid, and it is usually considered that a good work on steam engineering is one of the best things that a young engineer can have in his possession, and the more frequent use he makes of it and the more attentively he studies what is laid down therein, the greater will be his progress in the business ; but he must not consider that because he has an idea of practice he is capable of putting that idea into practice with the same success that he can after he has had a few opportunities to try his hand at it and learn those points that he has most certainly overlooked. The greater number of rules pertaining to steam engineering are commonly laid down in the shape of formulas, and for this reason the student in practical engineering must study his arithmetic pretty closely, if he has not already become proficient in figures, as he will find that those who are most capable in practical engineering are those who have the ability to figure out and calculate the different problems that may present themselves, and one or more is quite likely to come up in practice every day.

The practical part of steam engineering consists in taking care of the machinery and keeping it in the best of order, and not simply, as some suppose, starting and stopping the engine and keeping the water in the boiler at the right height ; these things come in the daily routine and form a part of the picnic. The care of the boiler is quite important ; too much cannot be learned in regard to this piece of apparatus. Boilers differ greatly in type as well in construction, and the man who keeps himself posted on the different styles, studying out their strong points as well as their weak ones, will be the better able to get the best results out of the apparatus he may have in charge, as well as being able to take hold of a new plant containing quite different apparatus.

The economical use of steam is of itself a problem requiring considerable study, attention and investigation, and from the fact that improvements are being made every day, it is reasonable to suppose that a person must keep studying in order to keep up with the times. If the student in practical engineering, when reading on such subjects, comes across something that he cannot understand, it should be sufficient to indicate to him that he does not possess sufficient knowledge of the subject to make these things comprehensible, and for this reason he should give greater study to that particular subject until it is thoroughly comprehended. The principles of engineering, as put down in the books, are for the purpose of assisting those who are struggling to acquire a knowledge of the subject, and it is not well to overlook or pass by any of these without making a strong effort to understand them. While the student is studying the subject, it will be well for him, if he can find the time and opportunity, to converse with engineers who are well posted ; but he will find that his time is not put in to best advantage if he uses it in discussing such subjects with those who are no better posted than himself. The more opportunities a young man has for asssting the engineer about the work, making adjustments, lining shafting, doing such pipe work as he has to do about the boiler, grinding valves, and doing the work on the engine, the more he will be able to learn of such things, for such knowledge as this is gained only through the practice, and seems to be that part of the business that the majority of writers skip when making their books. A person that gives the subject sufficient attention and study will, in the course of a few months, be able to take a position as second engineer, but the greatest trouble with young engineers is that they are apt to consider their ability much greater than it really is, and this leads them to take hold of plants that they are not able to handle in a satisfactory manner. As to the cost of learning all of this, that depends more on the man than anything else, for it is not a question of money, only so far as the money serves to produce the books, etc., required to teach the principles. The principal part of it the man must learn by study and experience. It cannot be bought.

How to Fire a Boiler.

[A paper read by Mr. R. Hammond before the National Electric Light Association.]

It has been said that "the waste of fuel due to improper firing is often of more consequence than any other loss which is produced in the operation of a steam plant," but in a great many cases the waste of fuel cannot be entirely charged to improper firing, as there are other causes by which a waste of the evaporating power of the fuel is produced. The principal of these are :

First, the improper construction of the boiler in relation to grate surface, tube area, heating surface and combustion chambers ; unless these proportions are properly worked out, it matters little whether the firing be done by mechanical means or by the more intelligent fireman, waste of fuel must necessarily follow.

A great many contrivances have been placed on the market, such as mechanical stokers, and other means by which coal and air can be supplied to the furnaces of steam boilers for the purpose of obtaining good combustion without producing a waste of heat by allowing too much air to pass above the grates, or an insufficient supply below the grates ; by this statement I do not mean that any particular method of firing will produce any more heat from a pound of coal than nature put into it ; just as good results can be obtained from hand firing as have been obtained by the best mechanical means.

It is often the case that firemen are paid insufficient wages for the work they are expected to do. We should be as particular to have good firemen in charge of our boilers as we are in having good engineers in charge of our engines ; a good fireman should be just as capable of manipulating the furnace of his boiler so that his steam recorder and his coal and water records will show just as good cards as the engineer can show in the manipulation of the steam he uses in his engine. If we paid the same attention to all the details of the construction and setting of our boilers and their economical use of fuel as we do to our engines our steam plants would be far more economical. Everything is "shined up" about the engine ; engineers go into all the details of its construction and management, and the greatest care is taken in the figuring out of its proportions so that it will have the very highest pos-

sible initial steam pressure and temperature, and the very lowest possible terminal temperature and pressure; all endeavoring to get the greatest horse power from the pound of coal, this securing the greatest economy—these very same highly educated individuals who designed these engines, forget that all the power comes from the pound of coal, and pay little attention to how that power is transmitted from the coal pile to the engine. It is just as essential to good economy that the boilers should have the very highest initial or furnace temperature, and the highest possible steam pressure, and the lowest possible chimney temperature, as it is for the engine to be economical under similar conditions of high initial pressure and temperature and low terminal temperature.

Experiment has proved that bituminous coal requires 150 cubic feet of air per pound of coal for good combustion; an excess of air results in a waste of heat which it carries into the flues and chimney, and often a greater loss in an insufficient supply to produce good combustion.

In my experience for steam plant boilers carrying 80 to 160 lbs. of steam, I find that at least 20 lbs. of bituminous coal should be burned per square foot of grate per hour, and the air spaces of the grates should not be less than 50 per cent. of the grate area, and the draught pressure not less than one-half inch of water; if the grate surface is so large that only 10 lbs. of coal is consumed, it would be more economical to reduce the grate surface and burn not less than 20 lbs. with good draught, thus securing a good combustion. The same weight of coal burned on a large grate would not be as economical on account of the low temperature; the temperature of the furnace should not be less than 3,500°, and the ratio of the draught area through the tubes or flues should not be less than 1.6 nor more than one-quarter of the grate surface, and the proportion of heat surface to grate surface should be at least as 35 to 1.

Under the conditions just stated boilers should be fired very economically, whether done by mechanical means or by hand. I have noticed in firing marine boilers on the great lakes that the firemen spread their coal evenly over the entire grate at each firing, and they produce steam very economically, while firemen on coastwise steamers will pile up the coal just inside the furnace door, and as it becomes coked will rake it back over the incandescent fire and grate with equally as good but no better results in the way of economy than obtained by the lake firemen. Both of these ways of firing are equally good, but in all cases the grate bars should be entirely covered, and the amount of air required above the grate should be admitted from above instead of below the grate.

Different grades of bituminous coal require different methods of firing, and by a little experiment the experienced fireman soon finds out and adopts the best method of firing, and in all cases he should keep his flues and tubes clear of ashes and soot, as well as his fires and grate bars. In firing anthracite coal, the coal must be spread evenly over the grate in all cases, and like bituminous coal must be burned at a high temperature with good draught.

The steam users should see to it that all parts of their boilers and settings should be of equally good proportions for strength and economy as their engines, employ good, intelligent firemen as well as engineers, and see that both produce good indicator cards. By a little attention in this direction steam users will themselves soon become experienced firemen and engineers, and can readily tell whether the firemen and engineers are doing their duty.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE proprietors of the Belleville (Ills.) Gas Light Company will increase the capital stock to $150,000.

THE Franklin (Ind.) Gas Light Company's plant has been purchased by the Franklin Water Works Company, and the new owners propose to make extensive improvements on the gas service of the town.

MR. G. W. F. KIRK, Secretary of the Shelbyville (Ind.) Gas Light Company, in pursuance of a resolution adopted last month by the Board of Directors, has caused the publication of the following notice in the local newspapers: "It has always been the policy of the Shelbyville Gas Light Company to reduce the price of gas, whenever it is possible; and by the gradual increase of consumption the time has again arrived to make another reduction. Commencing with the 1st ot March the price will be as follows: When the consumption in a single month through one meter amounts to less than 1,000 feet the price will be $1.80 per 1,000; 1,000 to 2,000 feet, $1.70 per 1,000; 2,000 to 3,000 feet, $1.60 per 1,000; over 3,000 feet, $1.50 per 1,000. Hereafter there will be no charge for setting meters. This makes the price of gas cheaper in Shelbyville than in any other town of the same size within our knowledge, where the quality of the gas is considered."

THE "green goods" man has often been heard of and from in many sections of our free country, and following close upon his heels, in respect to the "peculiarities" of his business, comes the blackmailer, whose twin is the confidence man. The gas makers of the country, however, are often beset by individuals who are a composite of the three classes named above, and so it would be fair to assume that our "composite" bacteria ought to be scotched whenever it is possible so to do. Sometimes a trifle of free advertising is a benefit to people who wish to become widely known, and while an advertisement should never be printed in the reading columns of a newspaper—and the JOURNAL has always adhered to that plan—and as it is the exception which points out the steadfastness of a well observed plan, we will deviate this once for the sake of helping Mr. W. C. Williams to extend his circle of acquaintance among the gas fraternity. Some days since a correspondent of the JOURNAL received a circular and a list of questions which appealed strongly to his passions, and although he is of a religious turn of mind we fear that his thoughts, on reading their lines, if reduced to words, and printed from type, would not look very well or sound peaceful. However, he forwarded the enclosures to us, and we take this opportunity of reproducing the same without further comment, other than to say that Mr. Williams is a most remarkable man. His tersely told tales are like this:

STOCKS and BONDS. WM. C. WILLIAMS & CO., Promoters and Financial Agents. LOANS and MORTGAGES.

Room 12,
Commercial National Bank Bldg.,
175 Dearoorn St., cor. Monroe, CHICAGO, ILLS.,... ....189..

Mr.....

Dear Sir—I beg to inquire if you are in position to form a syndicate of capitalists for the purpose of putting in a new fuel gas in your city? The Parent Company I promoted here will have their plant in practical operation within a short time, and I now purpose to introduce the system in every city throughout the country. If you feel that you could secure and interest capitalists in your city and join me in promoting the same, I can assure you the percentage to be divided between us over and above what the capitalists would require will be thoroughly satisfactory to you; and a quicker deal you never had presented to you.

"Regarding this gas. It is a new gas of a chemical nature; it is a fixed and continuous gas; it is composed of air, steam, and any kind of coal—slack preferred—or any other substance that contains carbon. It is not a water or odorless gas; not explosive or dangerous; has the smell of wood alcohol; will not freeze; the pipes can be exposed. As it is a direct gas it does not require a holder. The size of the plant is small, as is also expense of same. We make fuel gas, but can furnish illuminating gas at the same time through the same pipe. The cost to manufacture is less than 5 cents per 1,000 feet. Fuel gas can be sold to manufacturing concerns at 15 cents per 1,000 feet; for domestic use, 25 cents per 1,000 feet; and for illuminating purposes, 50 cents. If you are disposed to join me, and to save time I enclose you a list of questions, which kindly have filled out and return at earliest possible moment. Questions 10, 11 and 12, regarding gas companies, please surely have answered. I suggest that you secure this from the gas companies without their knowing for what purpose.

"The terms to local companies give them controlling interest. I intend to place a plant in your city, without doubt, either by interesting local capitalists or securing capital here, but prefer your local parties to be interested and so have you interested.

"Treat all correspondence confidentially, and, on receipt of a favorable reply, I will give you further particulars and let you know when you can bring your parties with experts here to see this plant in practical operation; for it will be necessary for this to be done before final arrangements are made, but our negotiations can all be arranged and can be terminated upon your being thoroughly satisfied. Very sincerely yours, WILLIAM C. WILLIAMS." Sweet Williams!

THE second enclosure, which is the list of questions, is appended:

"Mr. .....Dear Sir: Will you please fill out and return the following list of questions as early as possible, and oblige, Very truly yours, Wm. C. Williams & Co., Room 12, Commercial Bank Building, Chicago, Ills.: (1) What kind of coal is used for manufacturing purposes—bituminous or hard? (2) What is the price of bituminous coal-lump? (3) What is the price of bitiminous coal-slack? (4) What are the principle sources of supply? (5) What kind of coal is used for domestic purposes; bituminous or hard; and what is the price? (6)

What is the total consumption of bituminous coal per annum, and the price per ton? (7) What is the total consumption of hard coal per annum? (8) State what number of manufacturing concerns, and quantity of coal used for manufacturing purposes? (9) How many gas companies? Price of gas per 1,000? (10) What is the consumption of coal by gas companies? (11) What is their output of gas, daily? (12) Do they supply fuel gas? (13) What quantity of fuel gas is used? (14) State if the manufacturing interests are located together, or how located in city? (15) Give population of city. (16) Character of the manufactories. (17) Name leading newspaper."

THERE the matters are, and they disclose a queer state of affairs. To say nothing of the discoveries which have been made by the inventor whose process Mr. Wiliams proposes to exploit—for instance, the delicate reference to the bases of the "new chemical gas," which are "air, steam, or any kind of coal"—we can but reach the conclusion that the "smell of wood alcohol" has so permeated Mr. Williams as to cause him to believe that the strength of his wind is sufficient to overpower the reasoning faculties of anyone who has money to invest, or the power to move a "syndicate of capitalists" forward to the point of establishing a gas plant for the manufacture of a "direct gas," which combines the advantages of a strictly fuel gas with those of a high illuminating power medium, to be conveyed in the one main—at varying rates of pay for the service. Corn cobs and potato extract are not in it with this Chicago prescription; and as for the honesty and delicate sincerity of the motives which prompt Mr. Williams, these are best shown by his promise of a "quick deal" with satisfactory percentages, and the intimation that it would be wise to obtain replies to queries, 10, 11 and 12, by securing them under false pretences from the parties who were to answer them.

A FUEL gas plant has been installed at the United States Silk Mills, Hagerstown, Md., the product to be used in the finishing department.

THE necessary certificate, showing that the exchange of shares in the Denver Consolidated Gas Company has been effected, was recently filed with the Secretary of State.

THE Troy (N. Y.) Gas Light Company has been awarded a contract for the maintenance of about 300 public gas lamps in the city, at the rate of 8 cents per light per night. The Company was also authorized to supply the gas required in the public buildings, at the rate of $1.50 per 1,000. The contract is to last for one year, and the figures are similar to those that ruled last year.

MR. JOSEPH M. GAZZAM, President of the Williamsport (Pa.) Gas Company, has been re-elected President of the Pennsylvania Club.

SUPERINTENDENT RAUCH, of the Bethlehem (Pa.) Gas Company, has been having a busy time of late overseeing important plant betterments, made necessary by the increased demand for gas at that point. The purifying house has been virtually rebuilt, and some of the ideas worked out in connection with it are somewhat out of the common. In any event, Messrs. Morris, Tasker & Co., have just completed for the Company a set of 3 purifiers, 10 feet by 16 feet, by 4 feet, that have been placed tandem. They are controlled by a dry center valve, and in accordance with Mr. Rauch's instructions, each box is equipped with two 4 inch bottom valves. Twelve years ago the Company began to manufacture water gas, but lime purification was not abandoned until perhaps 3½ years back, when the Connelly iron sponge was adopted. The plan of revivification *in situ* was also followed; and while the results in the latter direction were not all that was anticipated, nevertheless they were satisfactory enough to warrant a continuation of the system. Mr. Rauch hopes to accomplish much from the bottom valve equipment noted; and he reasons it out thus. (1st), when a box is to be revivified he proposes to open the lower vents and lift the cover thus drawing the air through the mass from below; the vents to be opened up as far as necessary to keep the action continuous. (2d), when it is desired to "slow" the action, the cover is put on, and the top vent and lower vents are opened, as required. (3d), if it is desired to hasten the process, lower and lift covers from time to time, the bottom vents being open. (4th), if it is desired to add moisture, sprinkle the top layer with warm water, when the mass is cold, or with cold water when the mass is warm, lower cover with lower vents open, and raise cover with top vent open; repeating this several times. On taking a box into circuit, the air can be blown out by means of bottom vents. Mr. Rauch adds that he recognizes that all vents are elements of danger, and being such appreciates the necessity of seeing to it that they are kept tight.

MR. WILLIAM H. MOORE has resigned from the service of the Plainfield (N. J.) Gas and Electric Light Company.

MR. EUGENE H. YORKE, formerly Superintendent of the Brockton (Mass.) Gas Light Company, is now in this city, having made a most satisfactory arrangement with Mr. John Parr, a dealer in contractors' supplies, with headquarters at No. 647 Eighth avenue. The reasons for his new departure are the satisfactory ones of higher salary and an opportunity for speedy advancement. We hope, however, that Mr. Yorke will see his way clear to a return to the gas business, and meanwhile he can remember with satisfaction the fact that the send-out of the Brockton Company was doubled during the the time of his administration.

MR. W. A. ALDRICH, at one time a prominent factor in the financial management of the San Francisco Gas Light Company, died on Feb. 25. He was born in Westmoreland, N. H., on March 28, 1824, and settled in California in 1850, eventually amassing a large fortune.

ABERDEEN, So. Dakota, is to light its streets by means of arc electric lamps, the contract to run for 10 years.

MR. JOHN HODGSON has resigned the Superintendency of the Westerly (R. I.) Gas and Electric Light Company.

THE Engineer for the Commissioners of the District of Columbia submitted the following recommendation for insertion in the appropriation bill for the District, now under consideration by Congress: "In case of failure on the part of either Gas Company to supply gas sufficient in quantity and illuminating power to satisfactorily light all or any part of the street lamps assigned to that Company by the Commissioners of the District of Columbia, the said Commissioners are hereby authorized and empowered to require the non-defaulting Company to extend its mains by the shortest practicable route to connect with those of the defaulting Company, and to supply sufficient gas of the standard required by law to satisfactorily maintain the street lighting service for such time as may be necessary; provided, that all costs and expenses which may arise hereunder shall be charged against the defaulting Company, and unless voluntarily deposited with the Collector of Taxes, District of Columbia, shall be provided for as prescribed in the case of street railway companies, in paragraph 16, section 5, of the act providing a permanent form of government for the District of Columbia, approved June 11, 1878; provided, that each Gas Company shall, at its sole and entire expense, make reasonable extensions of its gas mains, whenever the said extensions shall be ordered by the Commissioners of the District of Columbia, as necessary for maintaining street lamps for the public safety and comfort."

MR. GEO. B. BURNS, Superintendent of the Bowling Green (Ky.) Gas Light Company, has been quite successful in extending the use of gas for purposes other than lighting in this pretty city on the oddly named Barren river, cooking stoves to the number of 42 have been placed, and the heaters in position number 62. He also has two gas engines—one of 8 and one of 4-horse power at work. Although last year an incandescent electric light plant was put in service at Bowling Green (the Gas Company operates it), the total gas output for the year was about equal to that for 1890, when gas had the field alone.

WRITING of the use of gas for domestic purposes at Bowling Green recalls the fact that the Company has hit upon a somewhat novel plan of interesting the Bowling Green matrons and maids in the matter of cooking by gas. As the plan is fully outlined in the circular bearing upon the matter that is being circulated by the Company, we reprint the same so that all may have a clear idea of the "novelty":

"*To be Given Away.—A Beautiful Gold Watch, valued at $...—Now on Exhibition in F. Maier's Show Window, Main Street.* The Bowling Green Gas Light Company proposes to give this elegant watch as an encouragement to cooks to become proficient in the use of gas cooking ranges, and will award it to the cook sending it, on May 2, 1892, the best baked white cake cooked on a gas range which they have used 30 days previous to that date.

"All cooks desiring to contest for this watch must send their names and addresses to the Gas Company before April 1st, when a card and envelope will be furnished them. On this card will be printed the following, viz.: Name of cook; location of store; number of stove; time

taken to bake cake. On May 2d this card must be filled out and sealed in a blank envelope and delivered to the Gas Company with the cake.

"All cakes so delivered will be placed on exhibition at some convenient hall, in charge of one of the ladies' aid societies, who will invite the public and select judges to award the prize. After the best cake has been decided upon the accompanying envelope will be opened and the name of the winner announced, after which all cakes will be sold at public auction and the proceeds given to the poor by the Society conducting the award.

"☞ On July 1st we will give another watch for the best jelly cake, and on September 1st a watch for the best chocolate cake."

AT the annual meeting of the Evansville (Ind.) Gas and Electric Light Company, as previously announced in these columns, Mr. Francis J. Reitz was re-elected President, but some days afterward he handed in his resignation. The capital stock of the Company has been reduced 50 per cent.; but an issue of $800,000 in bonds has also been arranged for.

THE Cicero (Ills.) Water, Gas and Electric Light Company has voted to increase its capital stock to $300,000 from $190,000.

MR. SAMS introduced (on March 4th) in the Maryland Legislature a bill providing for a State Board of Gas and Electric Light Commissioners. The bill provides that the Governor shall appoint a Commission of three members who shall constitute a Board, the members originally appointed to serve for one, two and three years, respectively, from June 1, 1892, and annually thereafter a Commissioner shall be appointed whose term of office shall be three years. The salary is put at $1,000 each per annum, the Commissioner who serves as Secretary to receive $500 additional. The salaries and all expenses of the office shall be paid by the gas and electric light companies of the State, in proportion to their gross earnings. It is to be the duty of the Commission to see that this fund is collected, as are the taxes on other corporations. The gas and electric light companies shall make annual returns to the Commissioners of income, expenses, dividends and salaries. The Board has authority to examine into the affairs of all companies manufacturing gas and electric light in the State as to quality, price, pressure, etc. The Board is required to give a public hearing on the complaint of a specified number of consumers as to imperfect service, overcharges, etc. Gas may not be supplied at a pressure in excess of that necessary "to support a 2½-inch column of water." The Board shall have power to ascertain what degree of purity the gas companies can reasonably be required to maintain as to the gas supplied by them. Biennial reports shall be made by the Board to the General Assembly. Whenever any corporation shall refuse or neglect to comply with the lawful order of the Commission, the Attorney-General is directed to take such action as may be deemed advisable. The penalty fixed for a non-compliance with the law is a fine of $50 for every day a company refuses to comply with its provisions.

THE Common Council has revoked the charter of the Economic Gas Company, of Chicago, on the ground that its provisions were violated. The action was taken, as is the general rule respecting the procedure of that body, in most unseemly haste—in fact, without any semblance of investigation whatever. While there never was any good reason for the existence of the Economic Company, which was nothing more or less than a "strike" from its very inception, its charter, which was "regularly obtained," will stand the test of a much more severe strain than that of the revocation order of the Council.

IN our reprint of the paper entitled "Wrinkles*" read by Mr. H. H. Kelly, of Waltham, Mass., before the last meeting of the New England Association, an error occurred. In the second paragraph of "Wrinkle No. V.," Mr. Kelly is reported to have said: "We put, on a place over tee, about 3 inch by 4 inch, two bushels of stone lime," etc.; but what he said in reality was: "We put, on a place over tee, about 3 feet by 4 feet," etc.

AT a recent session of the Committee of Manufactures, Massachusetts Legislature, the matter under consideration was the order introduced into the House as to imposing a penalty of $1,000 upon gas companies for each violation of the law which requires them to make a full return once a year of their financial condition, etc. Commissioner Barker stated that the returns were very late in coming in from some companies, and in some cases it had been found necessary to complain to the Attorney-General and get an information from the Supreme Court. Only 45 of the 130 companies in the State had made the returns within the legal time. He suggested a per diem penalty, as in the case of railroad companies, and he thought the penalty should be a small one for a short period of delinquency, increasing the forfeit as the delay extended. The delinquencies were mostly confined to the lesser Companies. He believed the law should also cover the delays of the electric lighting companies, as but a minority of the latter had complied with the law. In concluding his remarks, Mr. Barker said the views of the Commissioners on these points would be found at length in their annual report, then in the hands of the printer. Ex-Commissioner A. B. Coffin, now of the Boston Gas Light Company, stated that as a Commissioner he had seen the necessity of such a law, as in his last year the number of companies in fault was even larger than that reported by Mr. Barker. He believed in a per diem penalty (not to be an extravagant one), so as not to work hardships on the smaller companies. Commissioner Barker then remarked that as Mr. Mellen, who had introduced the order, was not present to state what he wanted or what his object was in introducing the same—he (the Commissioner) did not understand the exact purport of it—but he would say the Board now made very minute investigation and had full authority in the matter; as it was, the companies now objected to many of the questions asked on the ground that they were of too inquisitorial a nature. Mr. Barker concluded by remarking that the schedule under the present law was all that could in reason be asked for; and he believed that some amended form of procedure in respect to causing replies to be returned within the time specified by statute would be all that was necessary. The Committee thereupon decided to draft a new order which would embody some of the recommendations made by the Commissioners.

* *Ante*, p. 331.

ON April 12th Mr. John Ings, acting as mortgagee and trustee for the bondholders, will sell at public auction all the property, real and personal, of the Prince Edward Island Electric Light Company, of Charlottetown, P. E. I. The sheriff and his substitutes are rather busy these days with electric lighting properties. The Prince Edward Island Company's failure is most complete.

THE Directors elected at the annual meeting of the Wilmington (Del.) Coal Gas Company were the following: Edward Betts, Washington Jones, John Jones, Thos. Jackson, Dr. Jacob Derrickson, Samuel Bancroft, Jr., Edward T. Bellah and George S. Capelle.

A QUEER outcome of the General Meyer scheme to bankrupt the Gas Companies of Cleveland, O., is the action recently taken by the butchers occupying stalls in the Central Market Buildings. When the doughty Meyer and his associates determined that 60 cents per 1,000 cu. ft. was all the city would pay for gas, the Companies refused to accept that sum, and accordingly discontinued the supply of gas to the public buildings (one of which is the Central Market), and the authorities thereupon caused the buildings to be lighted by kerosene. The butchers put up with kerosene as long as they could, but something over a week ago they determined to emancipate themselves if possible from its stenches, and hence the following inclosure from a correspondent: "A committee of meat dealers from the Central Market visited the Cleveland City Hall a few days ago to confer with the officials regarding the lighting question. They said that the kerosene lamps in use at the market house had a disagreeable effect on the meat, and asked to have the market house illuminated with gas, they agreeing to pay out of their own pockets 40 cents per 1,000 cubic feet, the difference between the rate of 60 cents fixed by the city and the rate of $1 demanded by the Gas Company. President Morley, of the Cleveland Gas Light and Coke Company agreed to furnish the gas under that agreement, provided he received an order from the city. The question was referred to General Meyer, who was asked to decide whether the city could enter safely into the arrangement without prejudice to the hearing now going on in the Federal Court in respect to the 60 cent gas ordinance."

ON appeal, judgement was reversed in the case of Rhodes vs. the Washington Gas Light Company in which plaintiff in the lower courts secured a verdict of $2,500 against the Company, because of damages sustained by his unlooked for descent into a trench opened by the Company for the reception of a gas main.

THE Electric Light Companies—the Citizens and the Helena—of Helena, Montana, have buried the hatchet, and will hereafter chop the citizens instead of hacking at each other.

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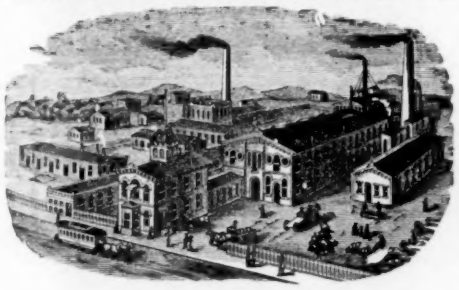

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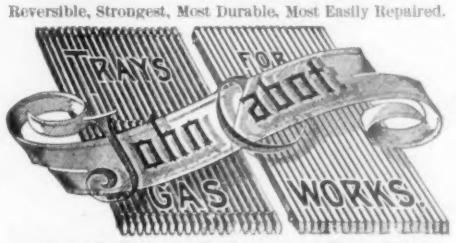

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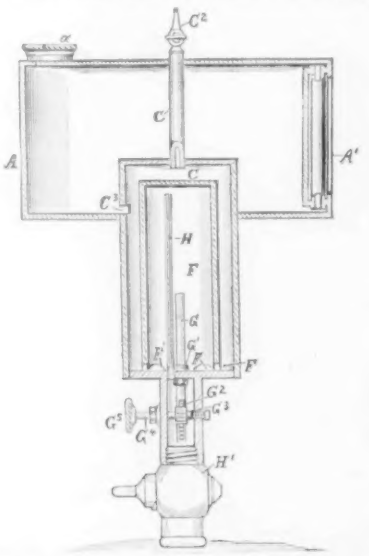

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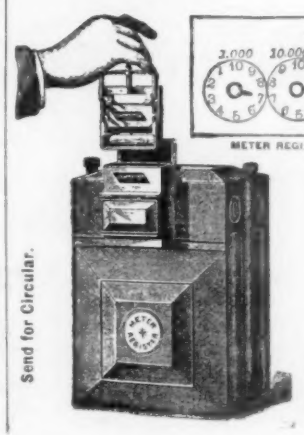

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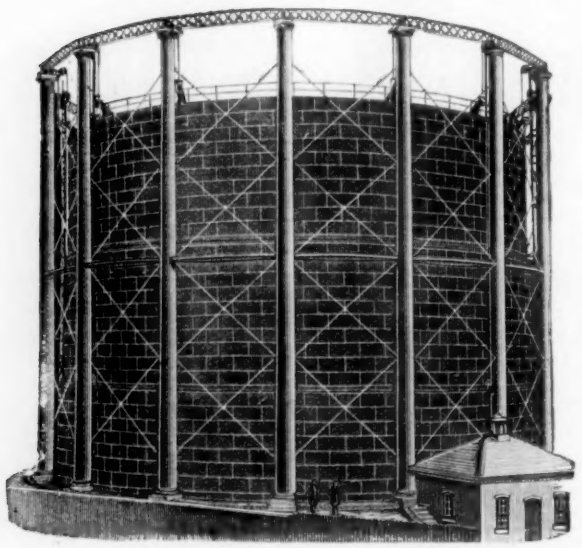

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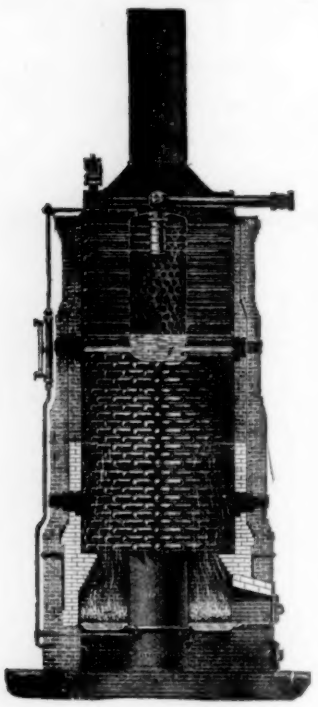

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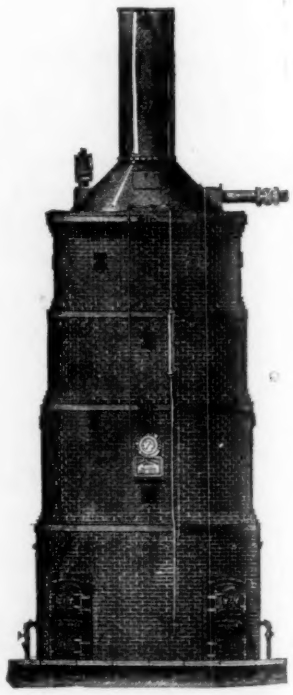

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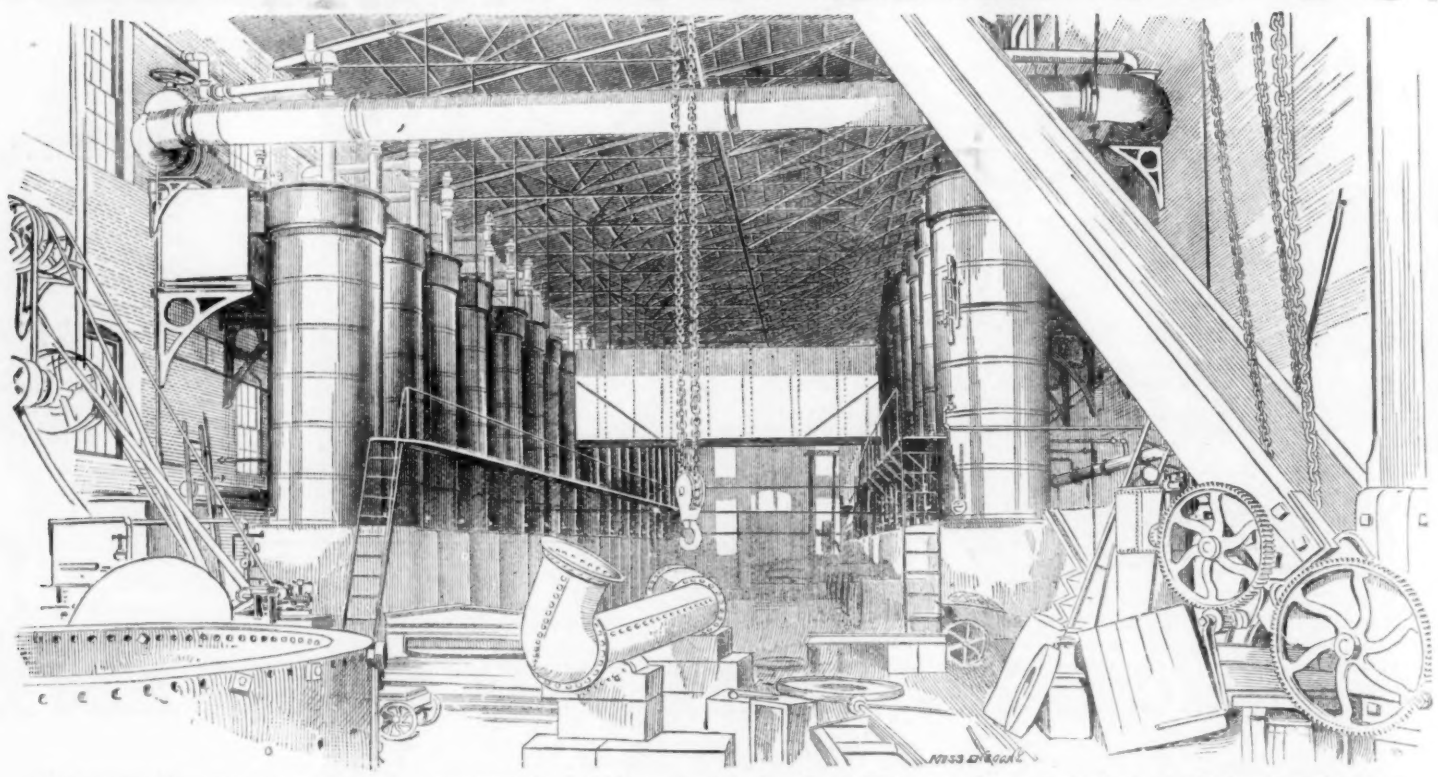

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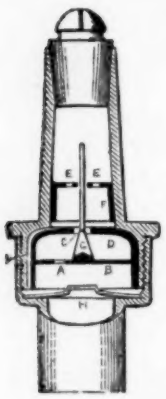

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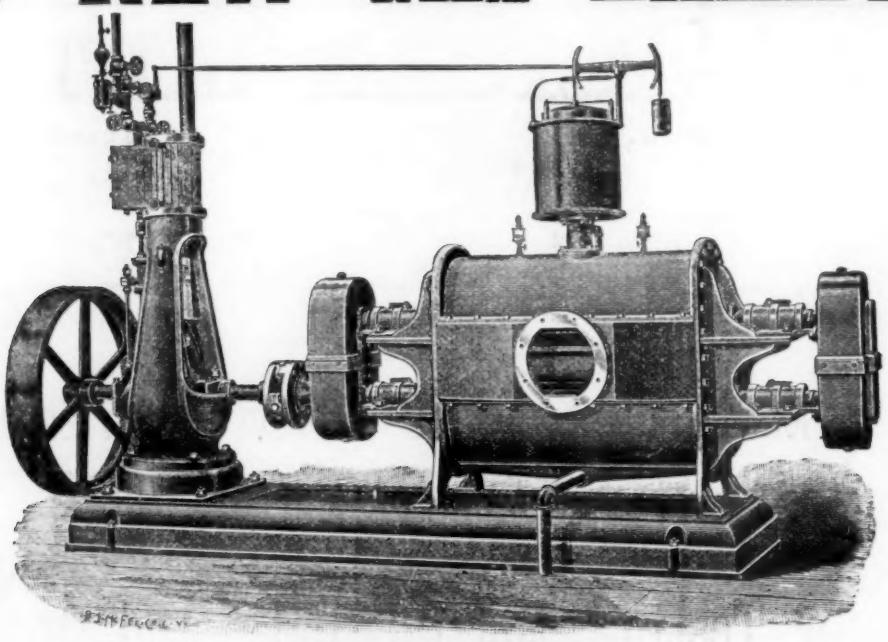

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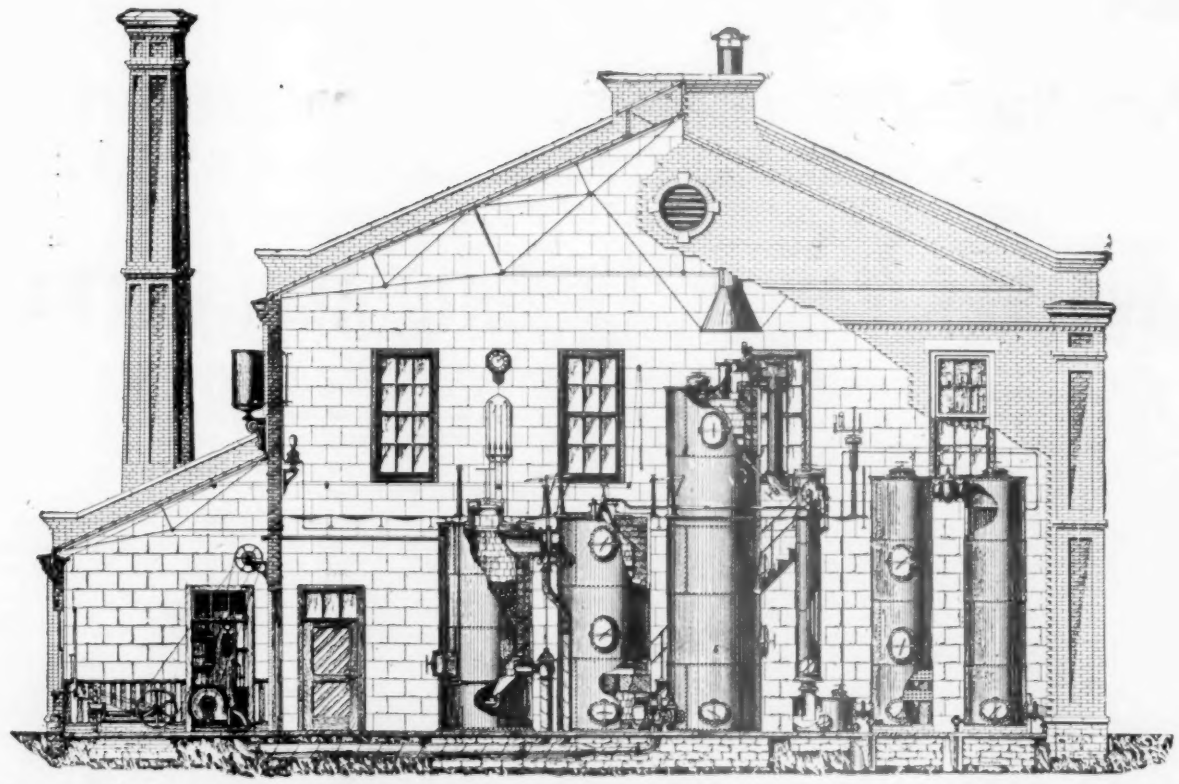

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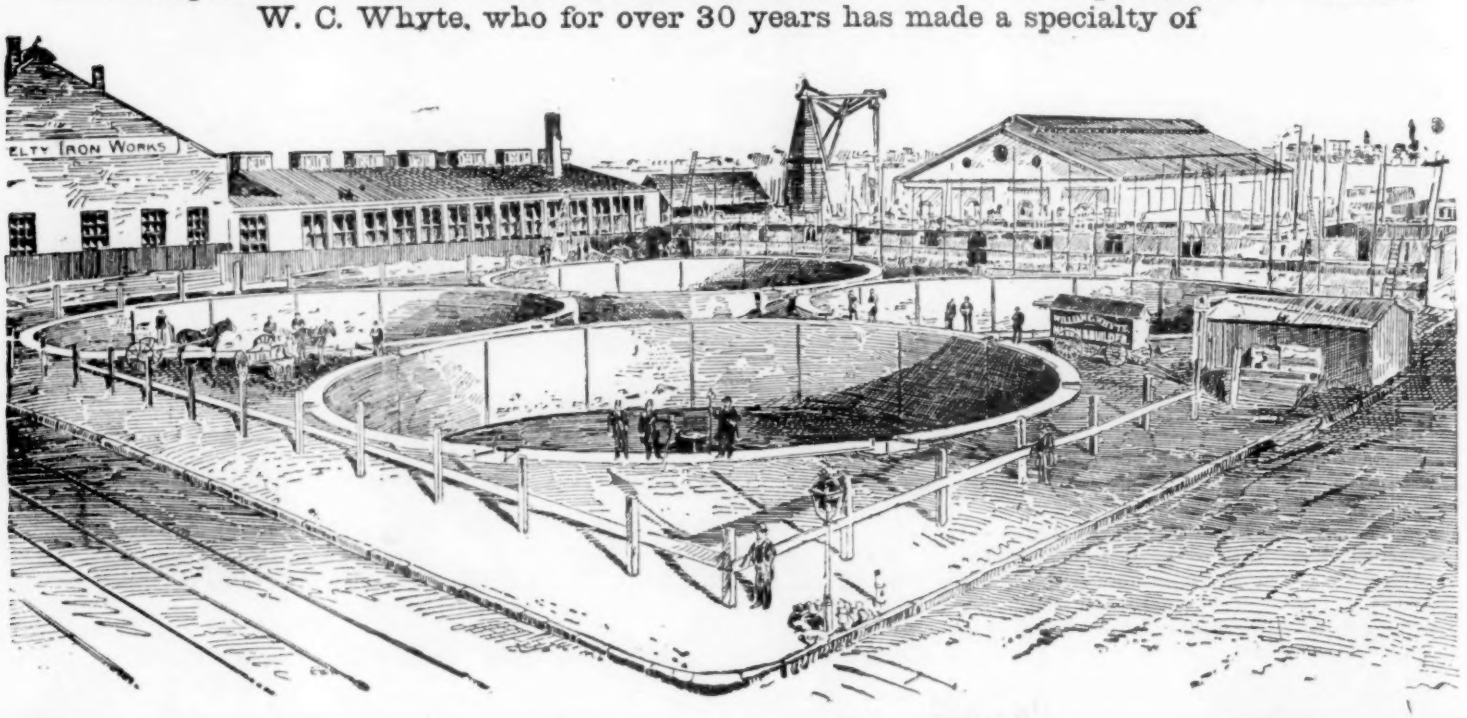

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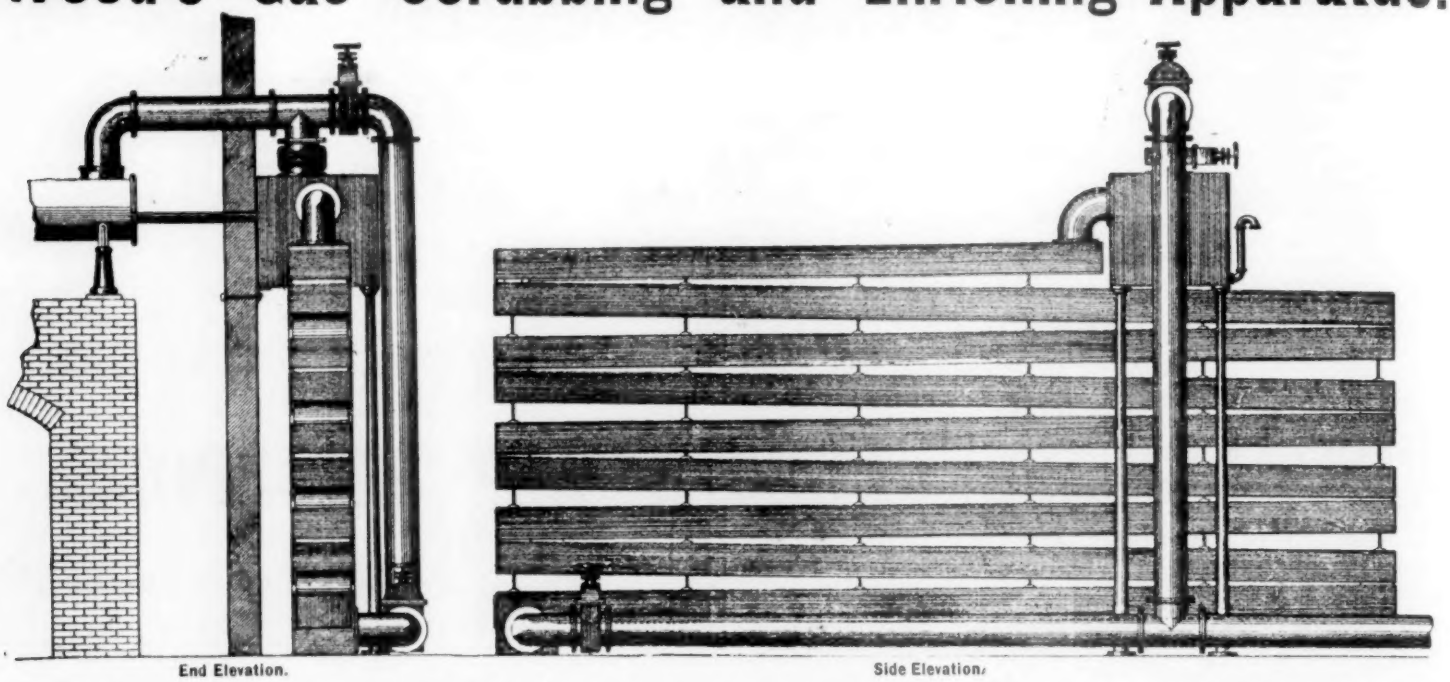

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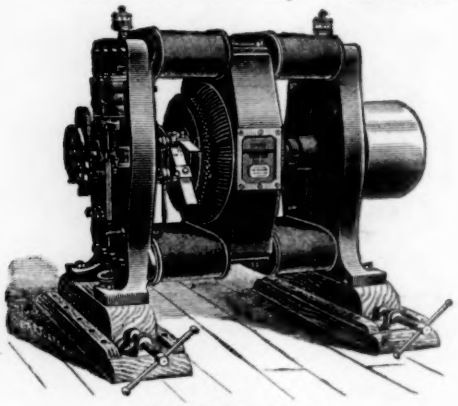

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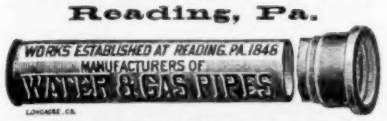

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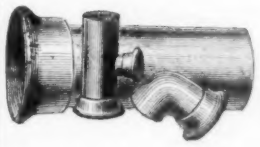

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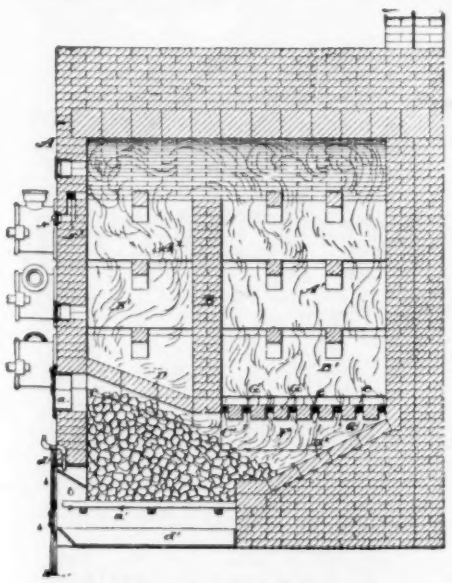

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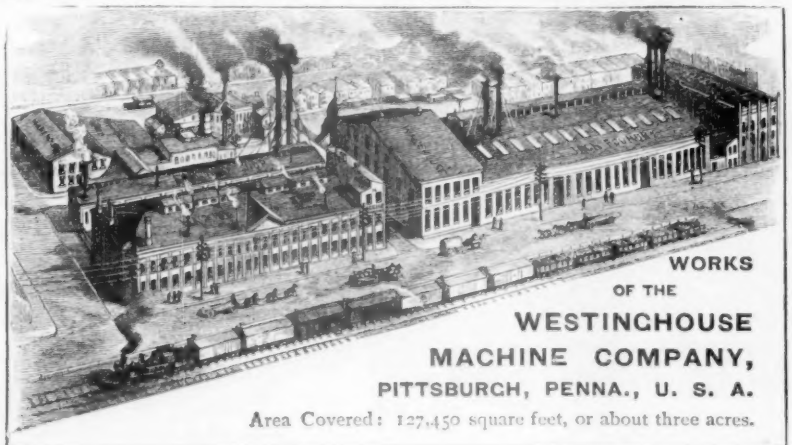

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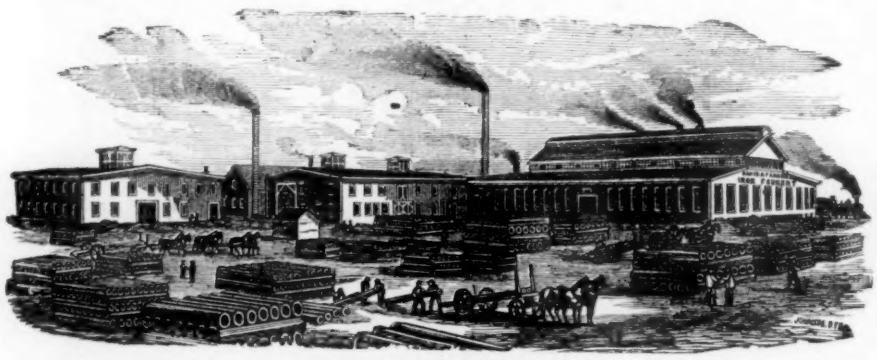

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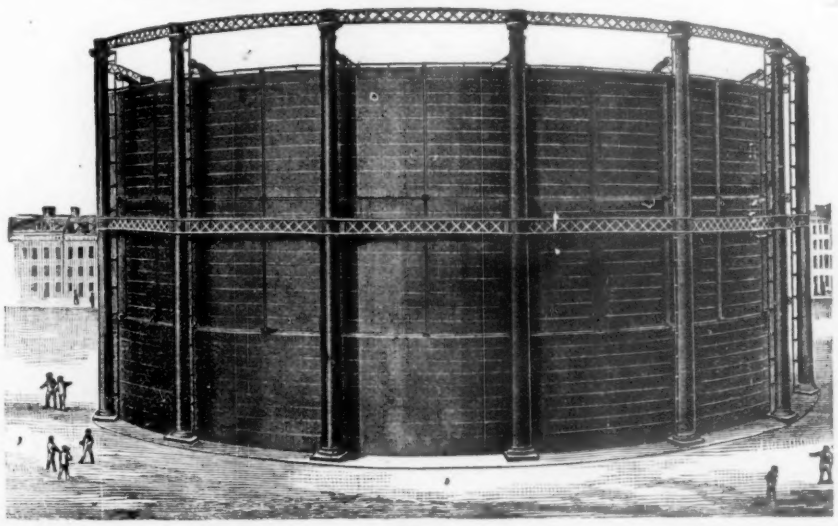

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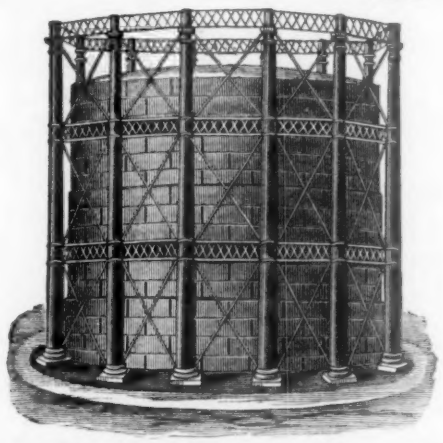

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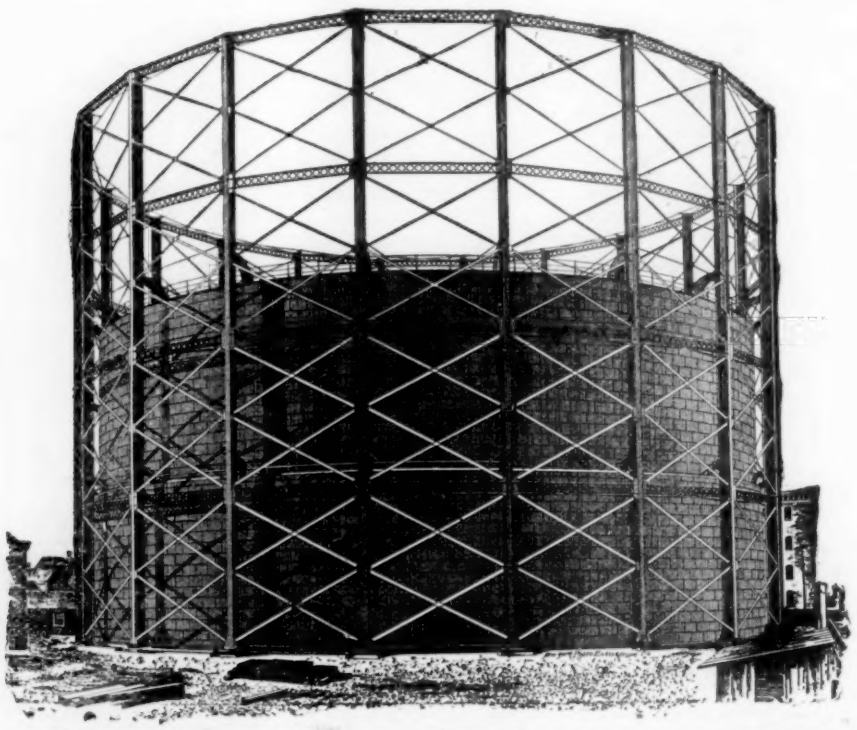

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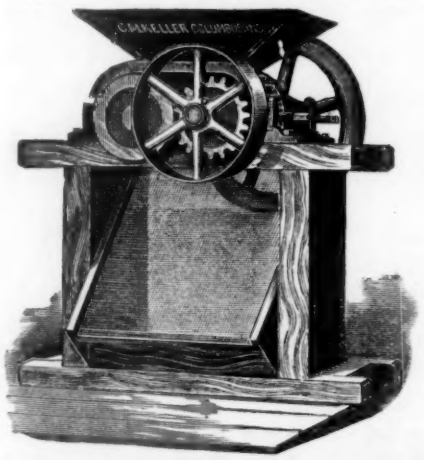

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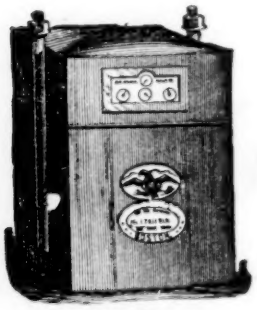

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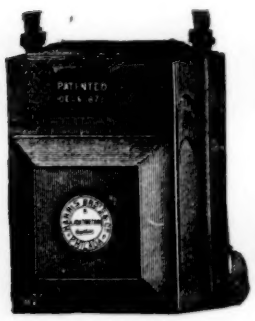

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